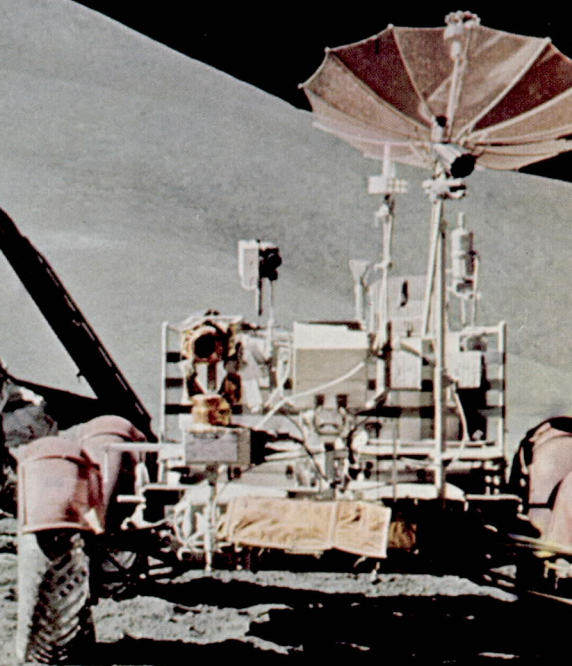
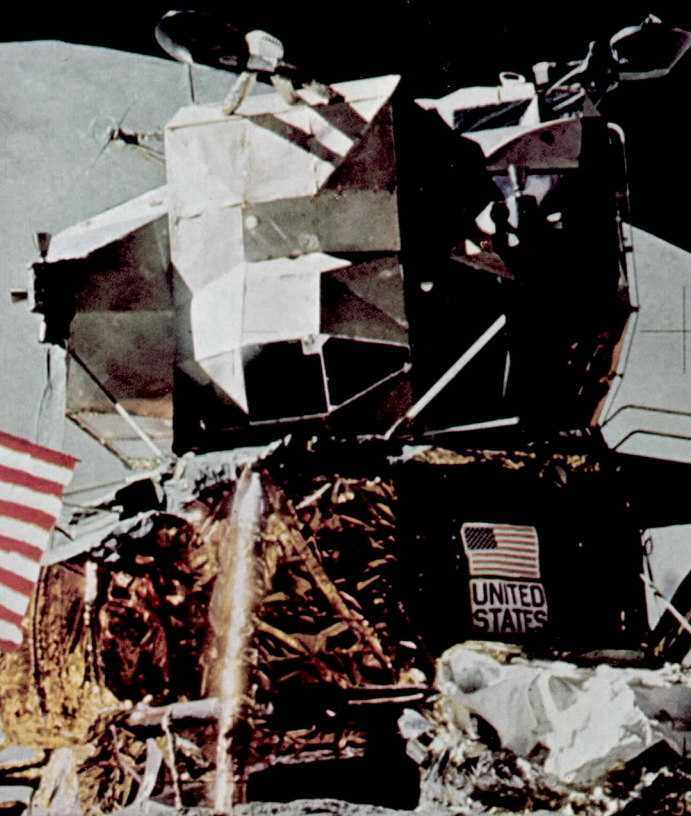


Apollo 15

At Hadley
Base

ORIGINAL CONTAINS
COLOR ILLUSTRATIONS



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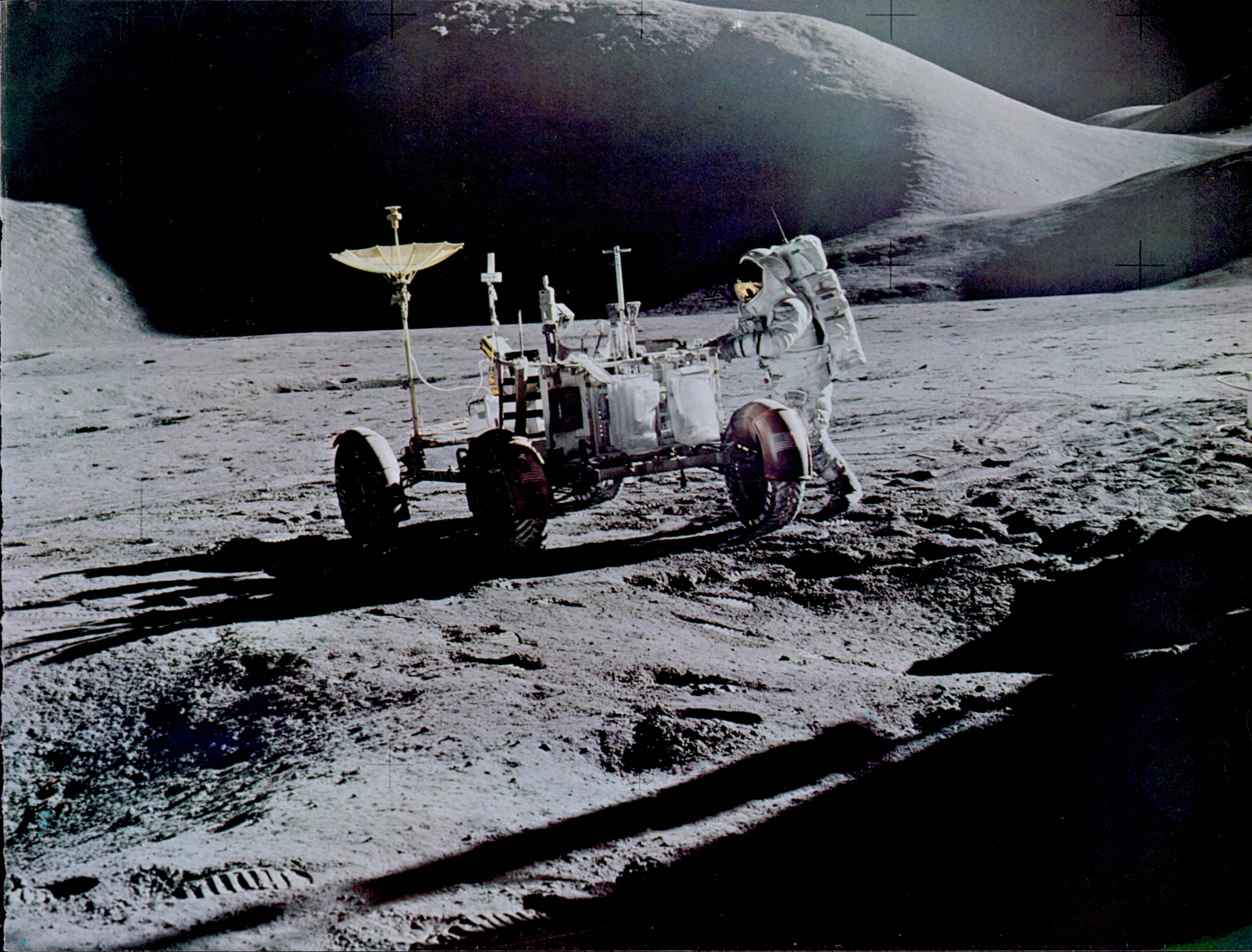
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Apollo 15

At Hadley
Base

Man must explore. And this is exploration
at its greatest.

— Astronaut David R. Scott



David R. Scott (Colonel, USAF),
Commander



David R. Scott was born June 6, 1932, in San Antonio, Texas. He graduated from Western High School, Washington, D.C. He has earned the degrees of Master of Science in Aeronautics and Astronautics and Engineer in Aeronautics and Astronautics from the Massachusetts Institute of Technology and a Bachelor of Science from the U.S. Military Academy. Scott was appointed a NASA astronaut in October, 1963. His previous space missions were Gemini 8 and Apollo 9. He is married and has two children.

Alfred M. Worden (Major, USAF),
Command Module Pilot



Alfred M. Worden was born February 7, 1932, in Jackson, Michigan. He graduated from Jackson High School and earned Master of Science degrees in Astronautical/Aeronautical Engineering and Instrumentation Engineering from the University of Michigan. He received a Bachelor of Military Science degree from the U.S. Military Academy. He was selected as a NASA astronaut in April, 1966. He has two children.

James B. Irwin (Lt. Col., USAF),
Lunar Module Pilot



James B. Irwin was born March 17, 1930, in Pittsburgh, Pa. He graduated from East High School, Salt Lake City, Utah. He received a Bachelor of Science degree from the U.S. Naval Academy and Master of Engineering and Master of Instrumentation Engineering degrees from the University of Michigan. He was selected as a NASA astronaut in April, 1966. He is married and has four children.

The Lunar Voyage of Endeavour and Falcon

"Falcon is on the plain at Hadley."

This radio report from Commander David R. Scott to Mission Control at Houston marked the successful landing on the Moon by the lunar landing craft of Apollo 15 at 6:15 p.m. EDT on July 30, 1971.

Falcon had alighted on the lunar plain called Palus Putredinis (Marsh of Decay) at 26°5' North Latitude and 3°39' East Longitude, on the half of the Moon facing Earth. Nearby are the lunar Apennine Mountains towering 15,000 feet above the flatlands and the mile-wide, meandering Hadley Rille, 600 to 1200 feet in depth. The landing site enabled the Apollo 15 expedition to study, in a single mission, three different types of lunar topography—a mare basin (plain), lunar rille (gorge), and mountain front.

The expedition's purpose was to gather information which would tell us more not only about the Moon but also about the Earth, the Sun, and the solar system. Because the Moon cooled earlier than Earth and has not been eroded by wind and water, it contains on and near its surface a record of the past that has been obliterated on Earth.

The ability of the Apollo 15 astronauts to explore was significantly enhanced by the use of a Lunar Roving Vehicle (LRV). After Scott and James B. Irwin, the pilot of Falcon, had unfolded the LRV from Falcon and set it up they began history's first drive on the Moon. During three separate motor trips, they explored the rim of Hadley Rille, the edges of deep craters, and the slopes of the Apennine Mountains. At a number of science stops, the astronauts turned on the LRV color television camera enabling viewers throughout the world to observe such spectacular vistas as the canyon depths of Hadley, the undulating crater-scarred plain of the Marsh of Decay, and the rounded peaks of the towering Apennines.

On their second lunar trip, the astronauts discovered a unique crystalline stone perched on a rock that was lying on an Apennine slope. They noticed, among other things, crystalline structure characteristic of plagioclase, a mineral that is a primary component of the rock anorthosite. Anorthosite is believed by many scientists to be the primary constituent of the primordial lunar crust, believed to have been formed some 4½ billion years ago. (A more familiar example of a plagioclase rock is the gem with the coincidental name of Moonstone.)

The possible discovery of anorthosite was important from another standpoint, too. It or some other material of comparatively light density was needed to explain apparent discrepancies between calculations of the total mass of the Moon and of densities of rocks collected by previous Apollo expeditions. All of the latter are denser than the Moon's average density.

The discovery of this rock prompted Astronaut Scott's message to Mission Control in Houston: "I think we got what we came for."

Another significant find is lunar bedrock discovered in the rim of Hadley Rille. The astronauts returned samples from this bedrock exposure that created the crater. This is the kind of rock believed underlying the lunar seas which were formed by lava flows. Analyses of such rock can give the time when the flows originated, some 3½ to 4 billion years ago at the Apollo 11 and 12 sites. The formations of the original crust and of the seas are two of the major landmarks in selenological (lunar geological) history. Altogether, Scott and Irwin gathered about 170 pounds of lunar rock samples. Many are unlike any brought back by previous expeditions.

Of comparable importance is the treasure trove of photographs snapped

on the Moon by Scott and Irwin and from orbit by Alfred M. Worden, pilot of the command craft, Endeavour. Most of the ground scenes were previewed by world TV audiences through the mobile LRV TV camera.

Among observations which, with other data and study, may result in significant new conclusions about the Moon are the following:

- The absence of the anticipated boulder fields below the Apennines.
- The gently rolling, uniformly smooth (but crater-scarred) surface of the Marsh of Decay.
- The well-defined layers, strata, and fracture lines marking the walls of the Rille and the Apennine mountainsides.
- The rounded contours of the Apennines and surrounding area. Sharper relief was expected.
- The large number of completely clean, rather than dusty, or partially buried, rock fragments. Their colors and textures could be easily discerned from as far as 10 to 15 feet. Describing his feelings as he photographed a cluster of such rocks, Irwin said: "It was as if we hit a gold mine."
- The different directions of layers in the walls of Hadley Rille and on the Apennine Mountain slopes. Hadley's were horizontal; the Apennine's, diagonal. This information suggests that they were formed at different times.

The Apennines are believed to be composed of material thrust up from below the surface by tremendous internal pressures built up when an object about the size of Rhode Island collided with the Moon and created the Sea of Rains. Hadley Rille is believed to have been caused by lava flows or by fracturing. The layering observed in both the rille and mountains confirms that the Moon's surface was built up in stages by many lava flows or ejecta blankets (showers of rock thrown up by impacts). Each layer

covers a different time period in the Moon's history and can give details on the Moon's formation and evolution.

The astronauts also drove core tubes as deep as 7 feet 9 inches into the lunar plain. Preliminary analysis shows 44 layers in the core sample, indicating at least 44 separate volcanic or impact events at this site. Some scientists calculate that lunar mare (plain) material of the depth collected is theoretically the equivalent of a hundred feet taken from the bottom of the deep seas on Earth. This is due to the fact that the Moon's surface has changed very slowly over great lengths of geological time. One of the things scientists are studying in the core samples are trapped solar particles. Such a study could provide details on the Sun's history during the past billion or more years and increase our understanding of how it influences Earth's climate.

Scott and Irwin also placed heat sensors (thermometers) down two of the holes they bored. The purpose is to determine the internal temperatures of the Moon, a fundamental measurement needed to understand the history and evolution of a planetary body.

While Scott and Irwin were working on the Moon's surface, Worden was collecting a wealth of pictures and other science data from orbit.

An X-ray detector, picking up secondary X-rays resulting when solar X-rays strike minerals on the Moon, indicated distribution of minerals. Among other things, the X-ray detector found high concentrations of aluminum and sparse amounts of magnesium in the highlands and the very opposite in the plains. The study of how minerals are distributed on the Moon may give clues to their distribution on Earth, helping mankind to inventory its limited mineral resources. X-ray detectors would not be effective over Earth because its atmosphere absorbs X-rays.

A magnetometer on the command craft also detected a very weak lunar magnetic field. Another instrument called a gamma ray spectrometer (like a Geiger counter) detected radioactive hotspots on the Moon that indicate concentrations of radioactive elements such as potassium, thorium, and uranium. The heat from such deposits could have melted rocks, causing local volcanic eruptions in the past.

Worden saw small dark conical mounds that he recognized as cinder cones (dead volcanic craters) on the Moon's Littrow area which is on the southeastern border of the Sea of Serenity. Carefully rechecking the area on subsequent orbits, Worden found no evidence of current activity such as flowing materials, gaseous emissions, or flares. But the cones indicate to some scientists that volcanic activity had lasted up to 1½ billion years ago. This could mean that the Moon was hot at least until then. And Worden says he identified these as cinder cones rather than impact craters because the rims are too high and the mouths of the craters too small to have resulted from impact.

Some scientists view the cinder cones as indicating that carbon dioxide and water may have been briefly present on the Moon. On Earth, large amounts of these two compounds are needed to bring the volcanic cinders to the surface and spread them around.

Volcanic activity on the Moon could originate from two possible main sources: 1) a former molten core, although many scientists say the Moon's core was never molten; 2) gravitational compression of material (on which more scientists agree). Also, rocks can be melted and volcanic flows created by radioactive heating and by impact of another body. In addition, the pull of Earth's gravity could crack thin crustal areas, releasing gases. Scientists attribute

current Moonquakes to Earth's gravity pull on the Moon.

The mass spectrometer aboard Endeavour identified pockets of neon, argon, and carbon dioxide in the lunar environment. If these are lunar emissions, they would indicate the presence of a tenuous and transitory lunar atmosphere.

Back on the Moon, Scott and Irwin had completed their work and returned to Falcon. At 1:11 p.m. EDT, August 2, they launched Falcon from the Moon. This launch was the first at which mankind could be a spectator. The TV camera on the Lunar Roving Vehicle, which was left behind by the astronauts, telecast the lift-off of Falcon for all the world to see.

Scott and Irwin also left behind the Apollo Lunar Surface Experiment Package which contained instruments to report on Moonquakes and meteorite impacts, the lunar magnetic field, the solar wind, the nearly nonexistent wisps of lunar atmosphere, and any heat escaping from beneath the Moon's surface.

After Falcon had rejoined Endeavour in lunar orbit and Scott and Irwin had returned to Endeavour, Falcon was cast adrift and later impacted on the Moon. The vibrations were picked up even by the Apollo 12 and 14 seismometers on the Moon which are nearly 700 miles away. On Earth, an impact of an object like Falcon on the Moon would be sensed by instruments no farther than 100 miles away. Analyses of data from the earlier crash of the Saturn upper stage on the Moon indicate a lunar crust at least 20 miles thick. Earth's crust varies from 3 to 30 miles with the thinnest parts being under the seas.

Before leaving lunar orbit, the crew of Endeavour launched a 78½-pound scientific subsatellite. It is providing new details on lunar gravity, particularly the high gravitational areas called mascons; on the Moon's space environment, including the effects of solar flares, and

of the Earth's magnetic field through which the Moon regularly passes; and on the weak localized lunar magnetic fields.

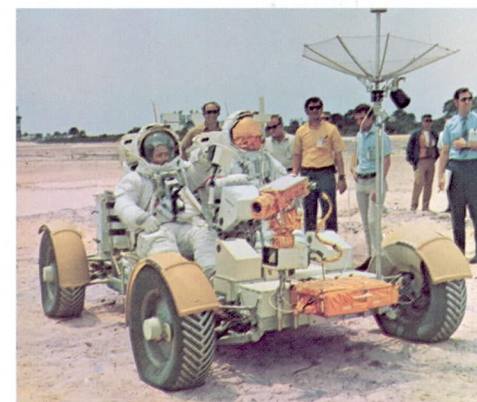
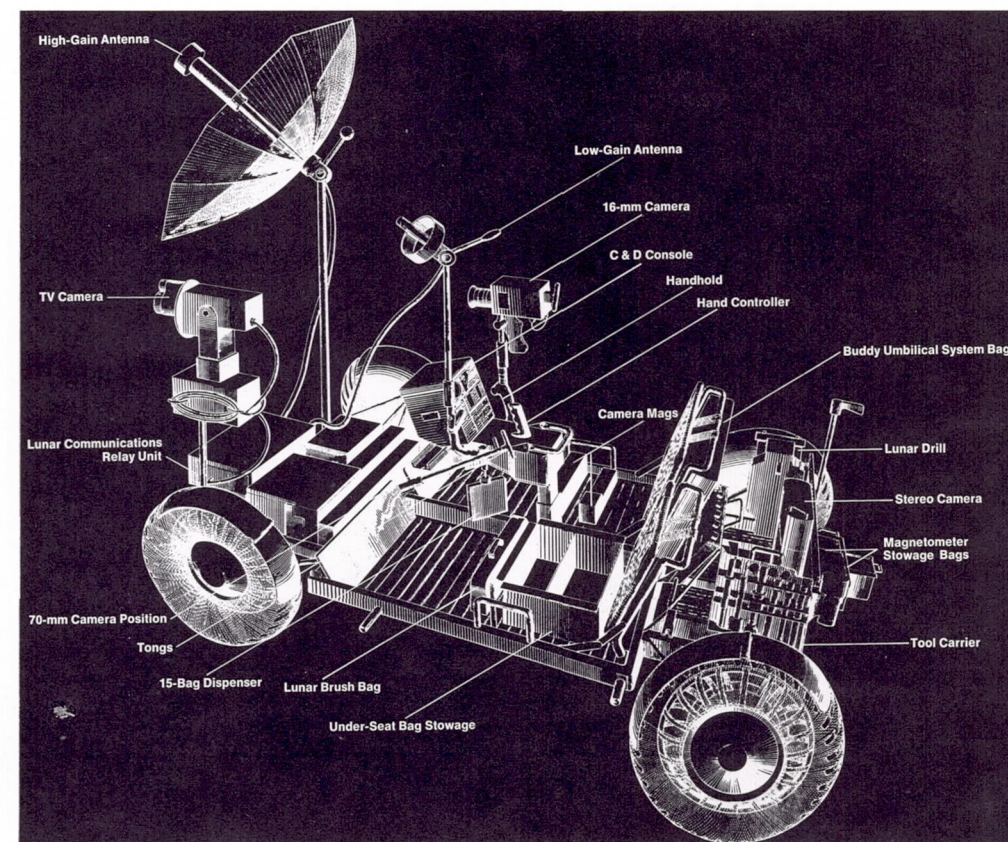
On August 5, still about 197,000 miles away from home, Worden performed mankind's first walk in deep space. The walk was necessary to pick up cassettes of film from the Scientific Instrument Module (SIM) bay and bring them back to the cabin. Otherwise the film would have been lost when the service module, in which the SIM bay was located, was discarded as the Endeavour neared Earth. Only the approximately 11½-foot-long command module of the 363-foot-long Apollo/Saturn V space vehicle, that takes off from Cape Kennedy, returns to Earth.

At 4:46 p.m. EDT, August 7, Endeavour splashed down in the mid-Pacific north of Hawaii. The landing was somewhat harder than usual, as only two of Endeavour's three parachutes remained open. Endeavour submerged briefly and bobbed up in upright position. The astronauts were not affected. But this ending reaffirmed the point that no mission yet has been without its problems and perils, regardless of the care that goes into making and assembling the nearly nine million parts that go into Apollo/Saturn V space vehicles. But as Scott said, paraphrasing other explorers in their eternal quest to replace ignorance with knowledge and to throw light upon the mysterious dark places:

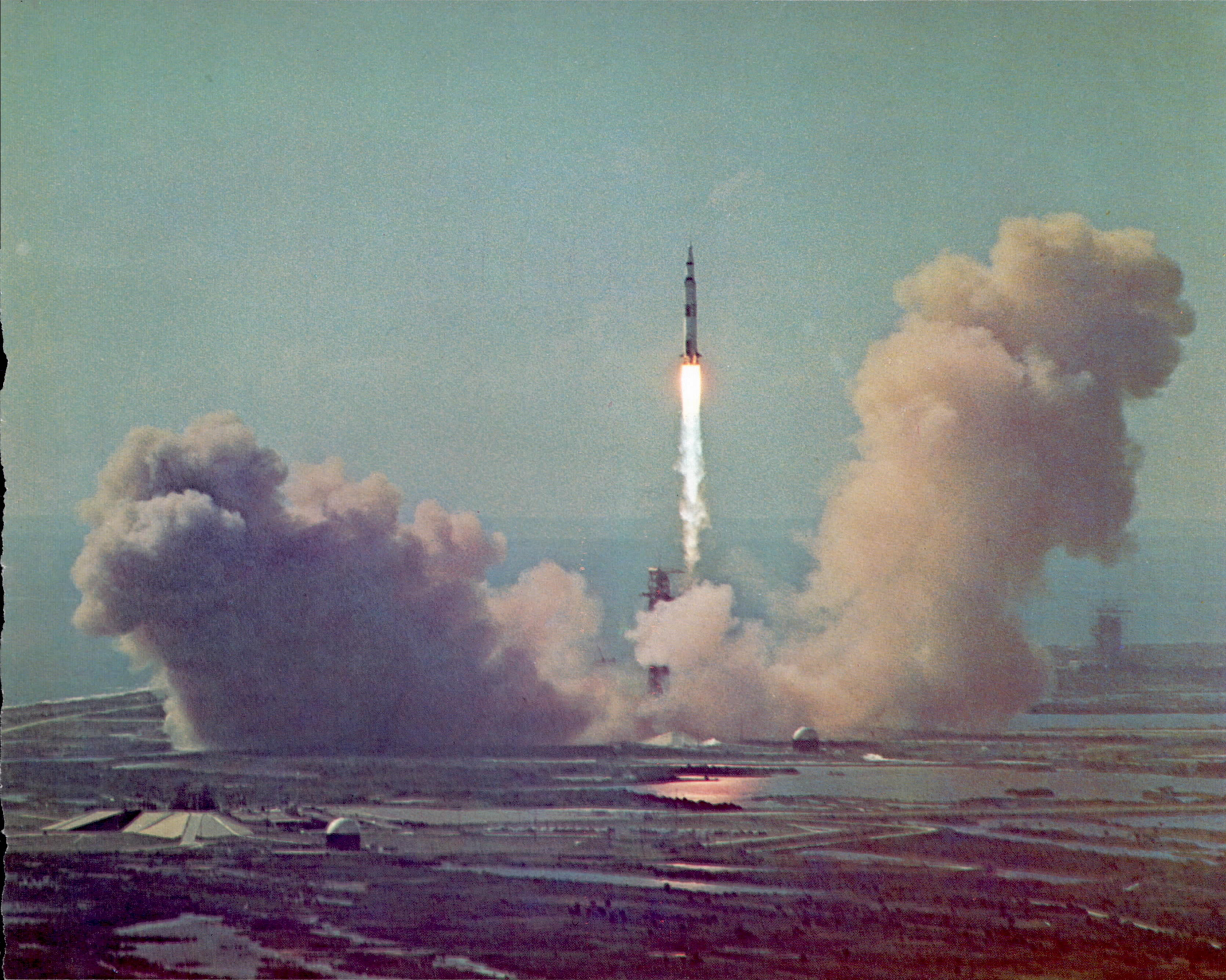
"As I stand out here in the wonders of the unknown at Hadley, I try to realize there is a fundamental truth to our nature. Man must explore. And this is exploration at its greatest."

The Lunar Roving Vehicle which the Apollo 15 astronauts used to explore the Moon can carry 1,080 pounds, Earth weight, which becomes 180 pounds on the Moon. It was designed for as long as 78 hours of operation and has a total range of about 40 miles.

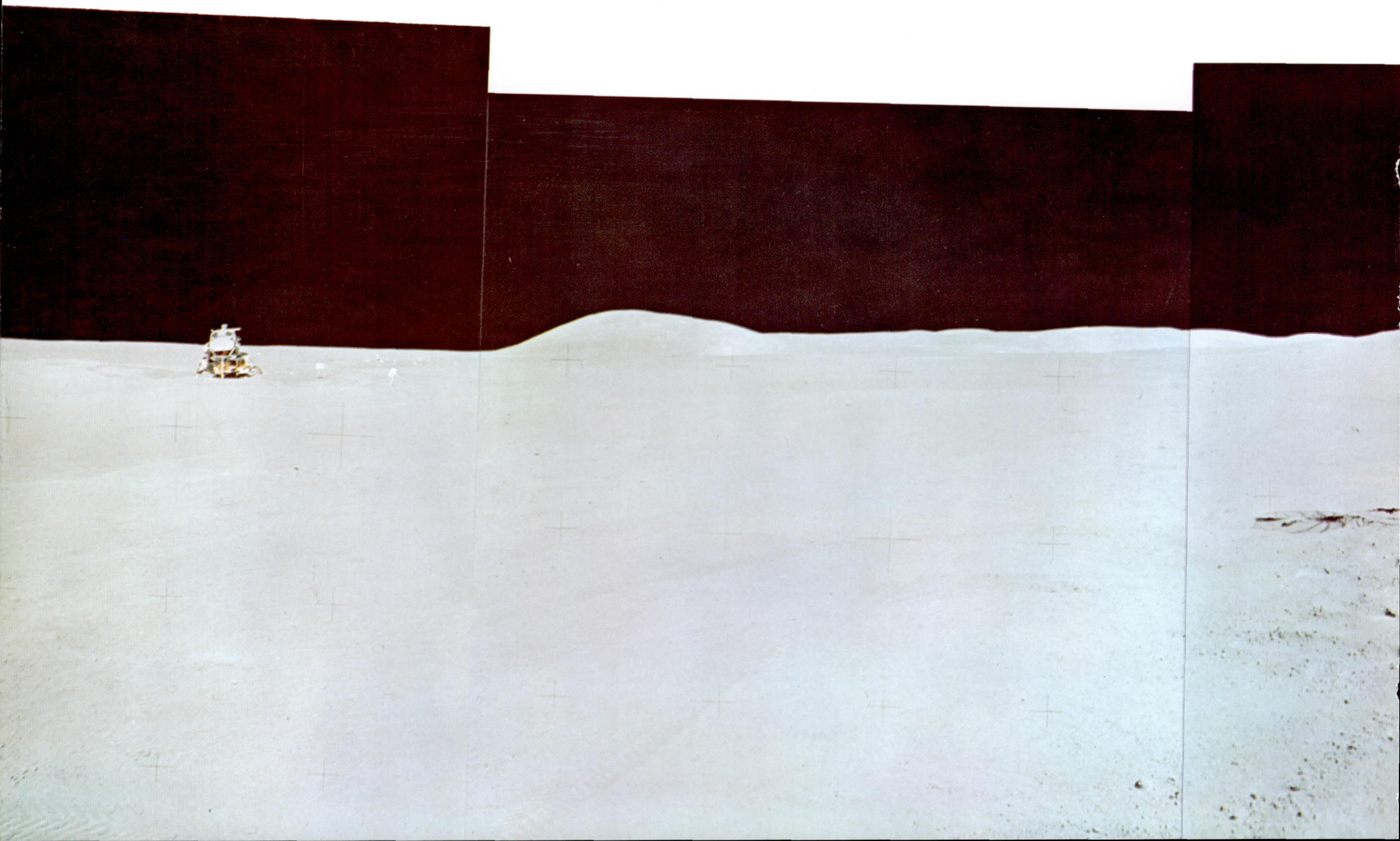
Apollo 15 is launched from Cape Kennedy, Fla., at 9:34 a.m. EDT, July 26, 1971.

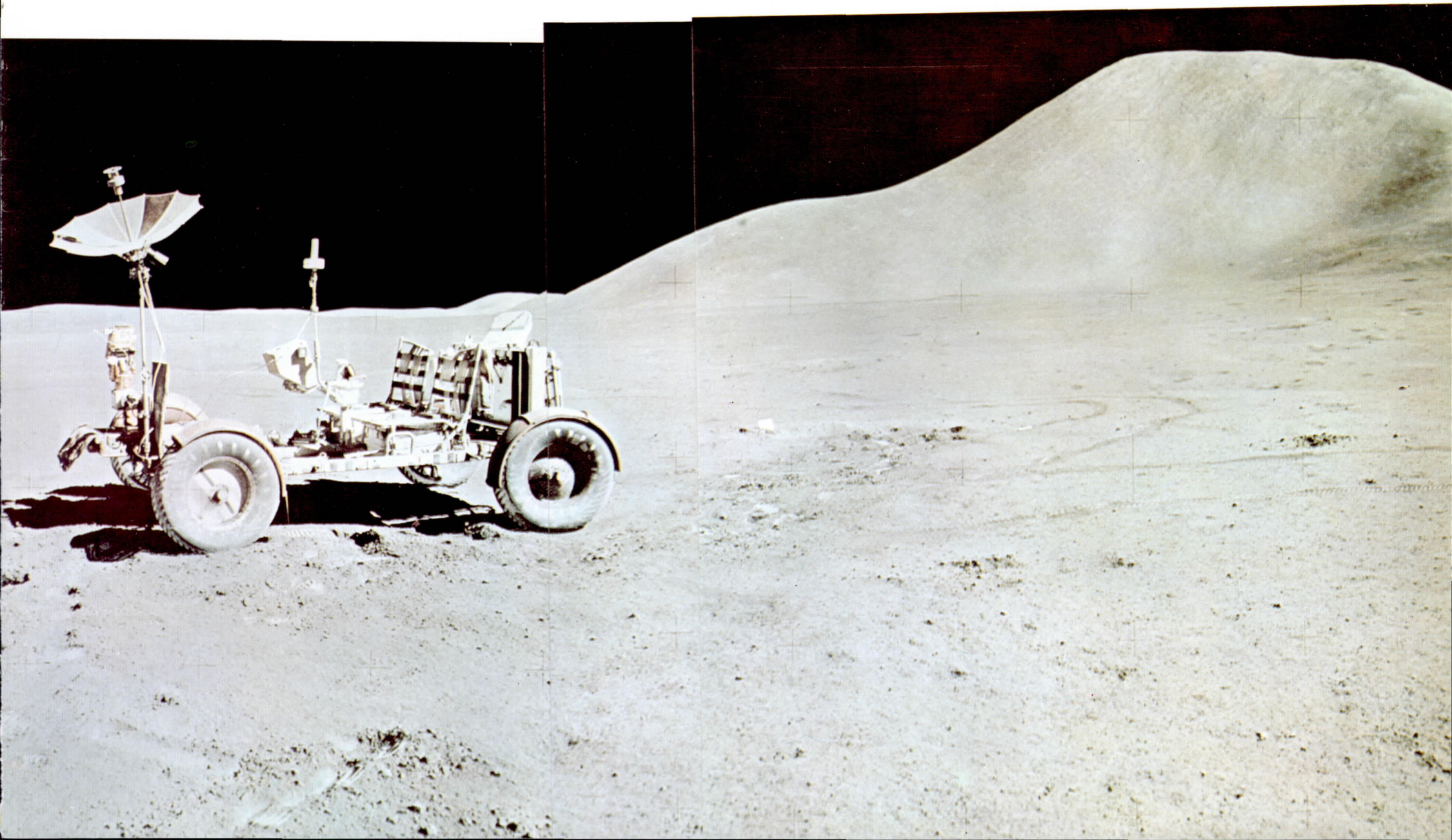


Astronauts Scott and Irwin test drive the Lunar Roving Vehicle during training.

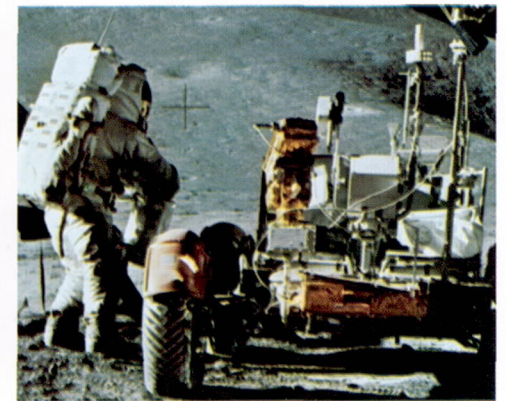
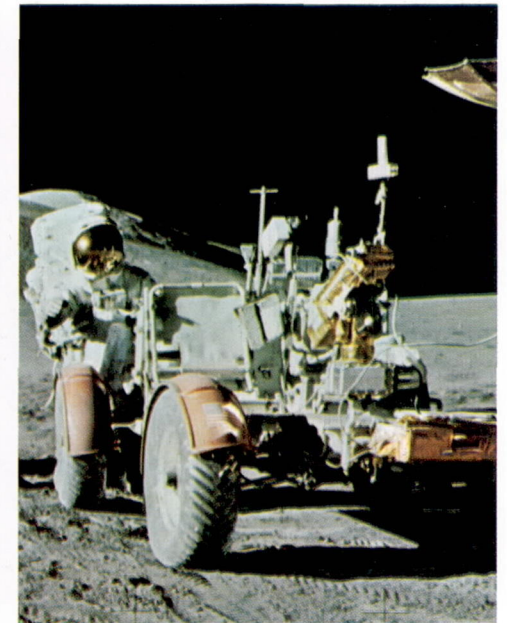
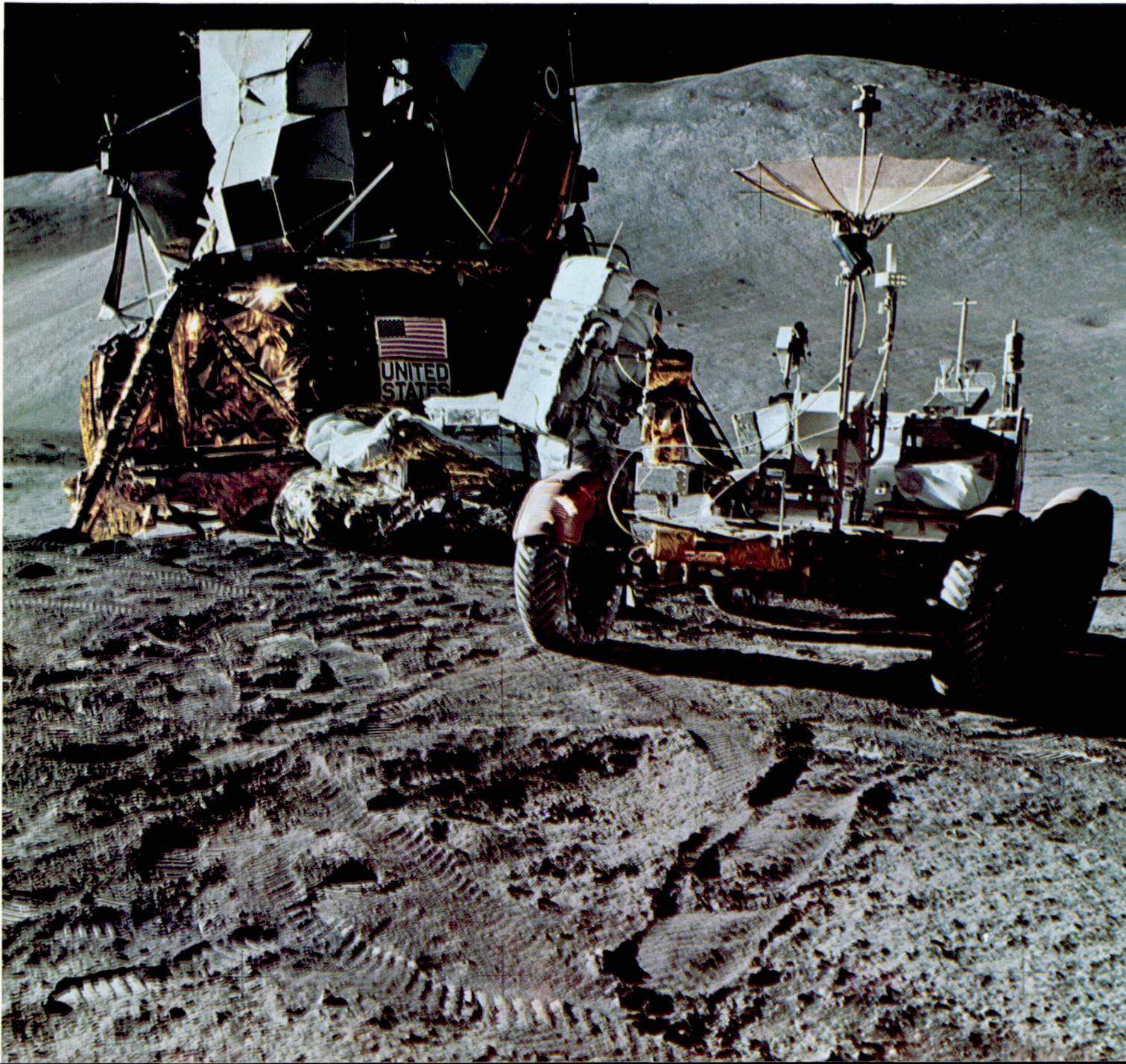


The Rover stands alone in this photograph taken by Scott toward the end of the third EVA period. Mount Hadley is at right. In the distance at left are Falcon, ALSEP, and Astronaut Irwin.

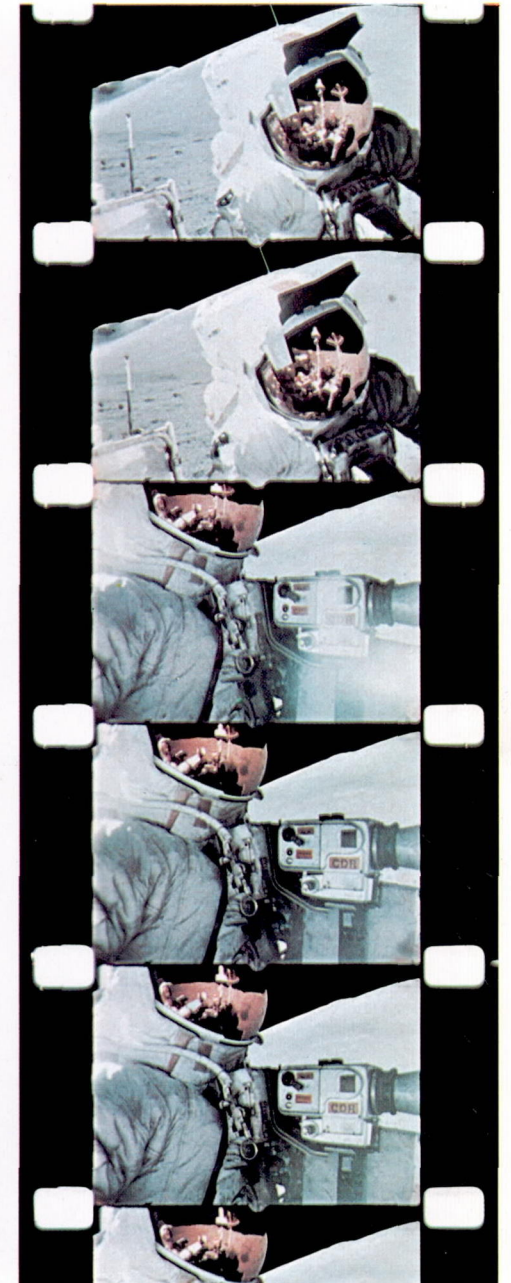
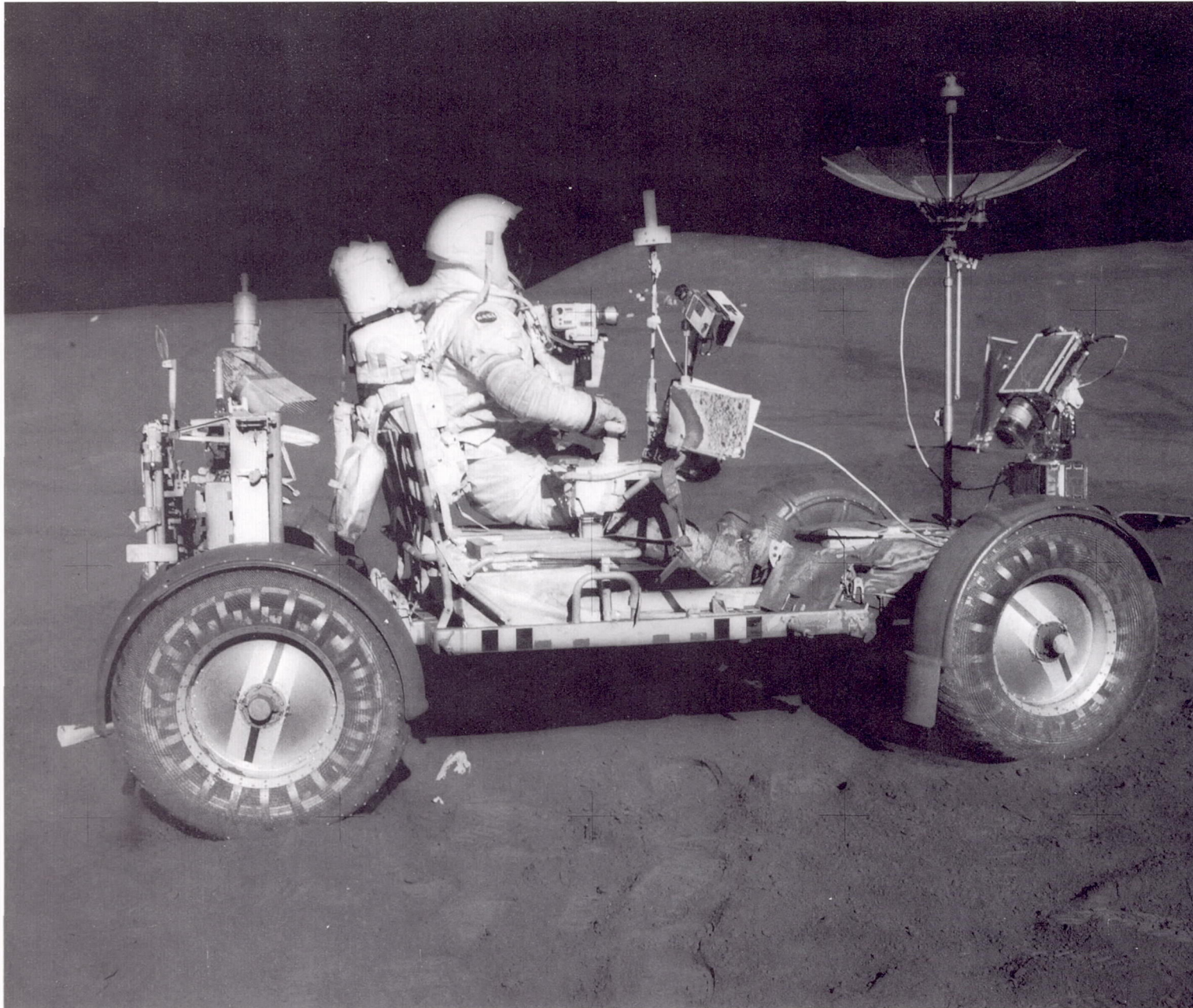




Irwin carefully checks and loads the Lunar Roving Vehicle after it has been unfolded from Falcon. While significantly expanding the scope of manned lunar exploration, the vehicle also tested vehicle operations in the hostile space environment as a contribution to future lunar and planetary exploration systems.



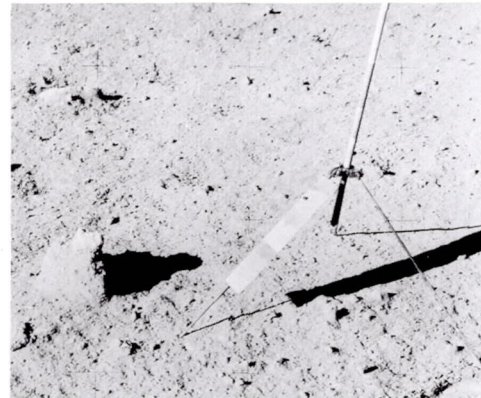
Scott boards LRV for first ride:
SCOTT: "That's a reasonable fit."
CAPCOM: "O.K., Dave. And buckle up for
safety."



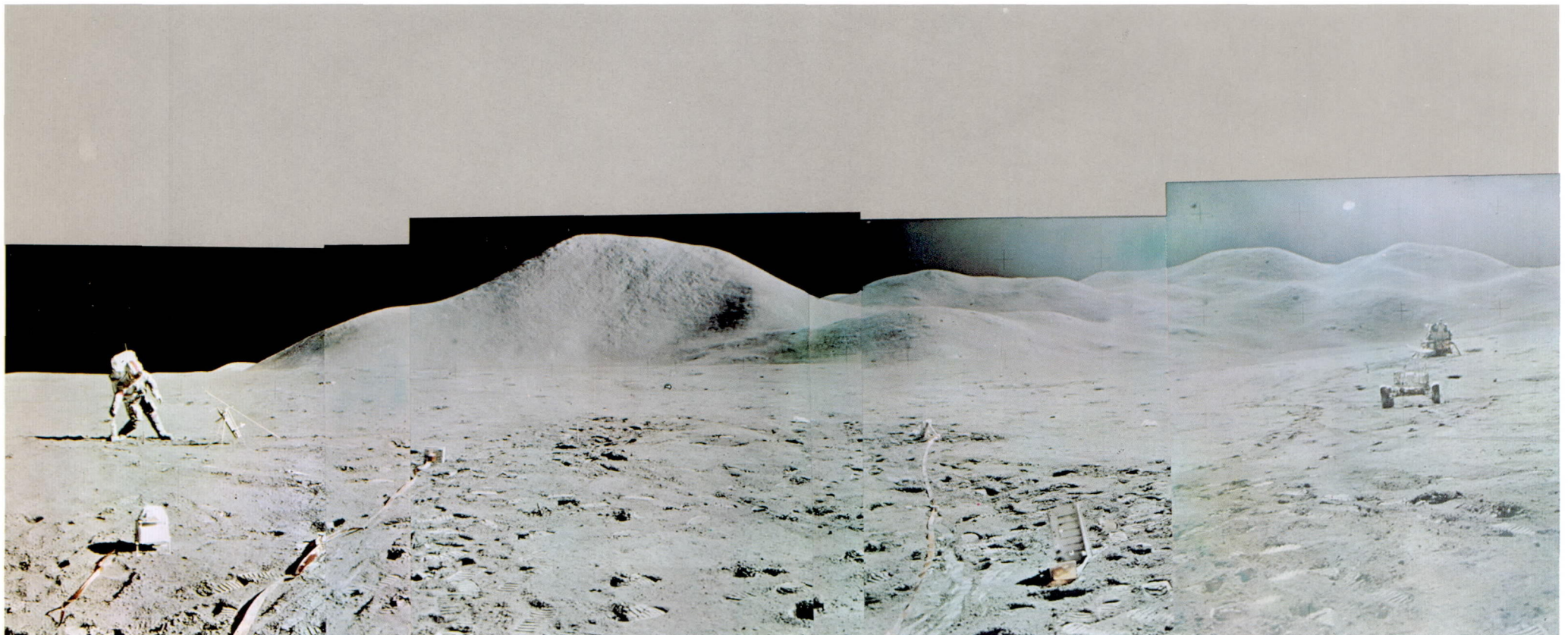
Perched on another rock is a unique crystalline stone, nicknamed the "white rock," that may be more than four billion years old. Its discovery prompted Scott to exclaim: "I think we got what we came for." Next to it is a gnomon which indicates local vertical and, by its shadow, Sun angle.

At left, Scott drills hole in Moon for placement of heat sensors. At far right are Falcon and the Lunar Roving Vehicle. Scott is nearly 330 feet west of Falcon.

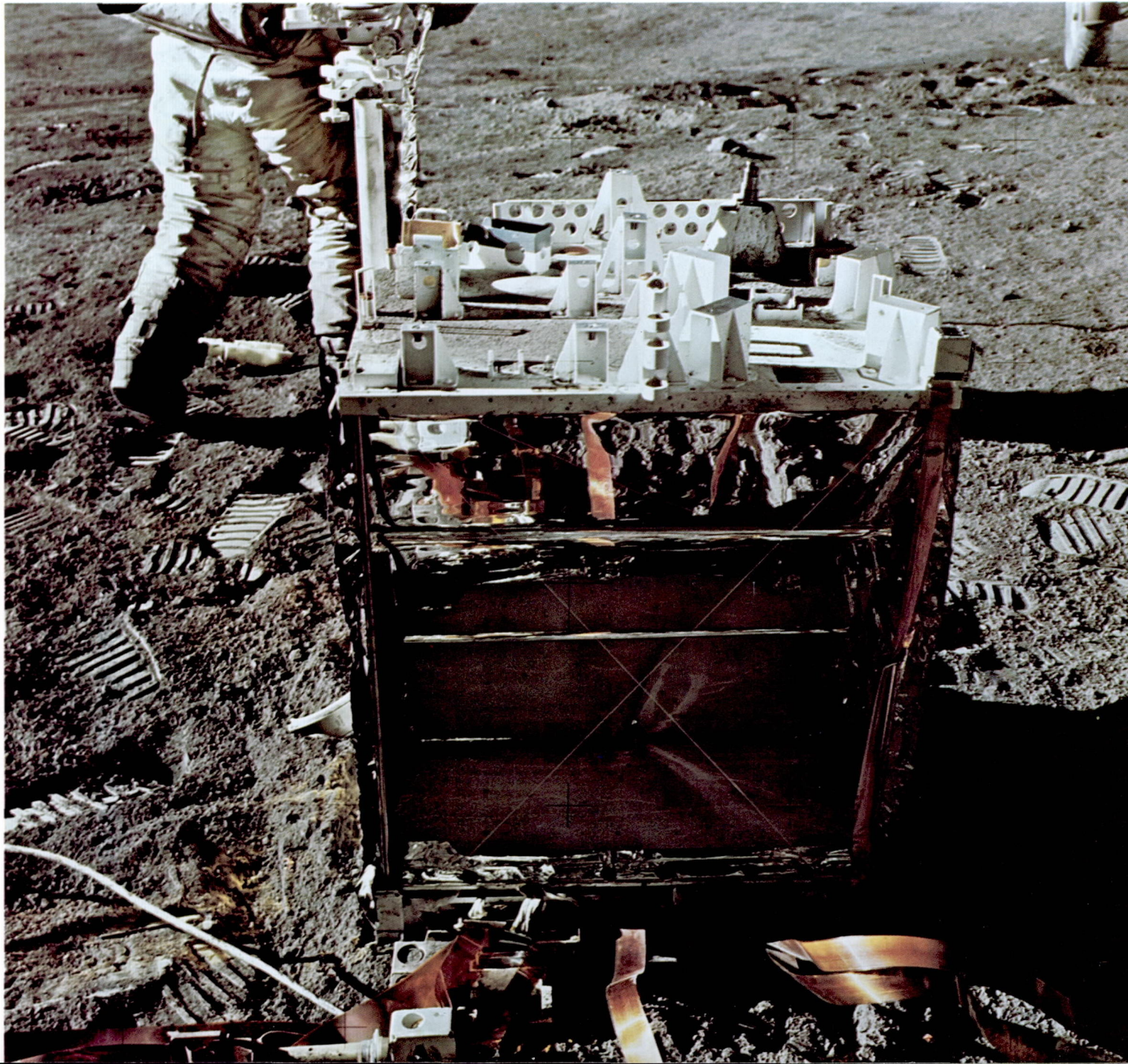
SCOTT: "We had some difficulties (in drilling) because we did not expect the regolith, or surface material, to be as packed as it was. . . . We had to compensate for that and I think that's why man goes to the Moon. . . . A machine would have stopped."



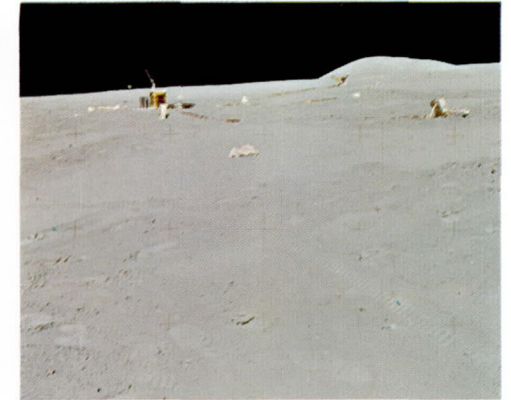
View of ALSEP and Falcon with Apennine Mountains in background. Falcon is tilted; Scott reported: "We're on a ten-degree slope." Mountains in background are approximately 3 miles from where Falcon landed.



Irwin unloads pallet of equipment from Falcon in preparation for lunar exploration.



View of Apollo Lunar Surface Experiment Package (ALSEP) site. The instruments, powered by nuclear energy, are continuing to report on Moonquakes and other lunar phenomena.



SCOTT: "Look at the mountains. When they're all sunlit like this, they're really beautiful."
IRWIN, quoting from the Bible: "I look unto the hills whence cometh my help."

Apollo 15's Lunar Rover Traverses

As Apollo 15 approached the Moon on July 30 a press briefing took place at Houston, with Astronaut Harrison ("Jack") Schmitt as the briefing officer, to provide background on the lunar surface EVA's (extravehicular activities). Dr. Schmitt was Backup Lunar Module Pilot for Apollo 15 and has been assigned to fly in Apollo 17 in December, 1972 as the first scientist-astronaut to go into space. Jack Schmitt opened the briefing with this statement.

The lunar missions are aimed at providing operational data, sample data, instrumentation data on two major questions that concern the Moon and indirectly, but more importantly, that concern the Earth.

The first of these is the question of what happened to the Earth in the first billion or two billion years of its history. Now a lot of people ask why in the world don't you study the Earth if you want to know about that. Well, we have been trying to study the Earth and learn about that early period of Earth history but the processes that take place within the Earth's crust—the erosion and deposition of mountains, formation of mountains, volcanic processes—have pretty well masked most of the clues as to what happened in these early days.

Why is it important to know in the first place? I feel it's important because in the long range of the human species' future we have to know more about where our materials for civilization are; and the controls on the original distribution of these materials are locked up in the events that happened in this early time.

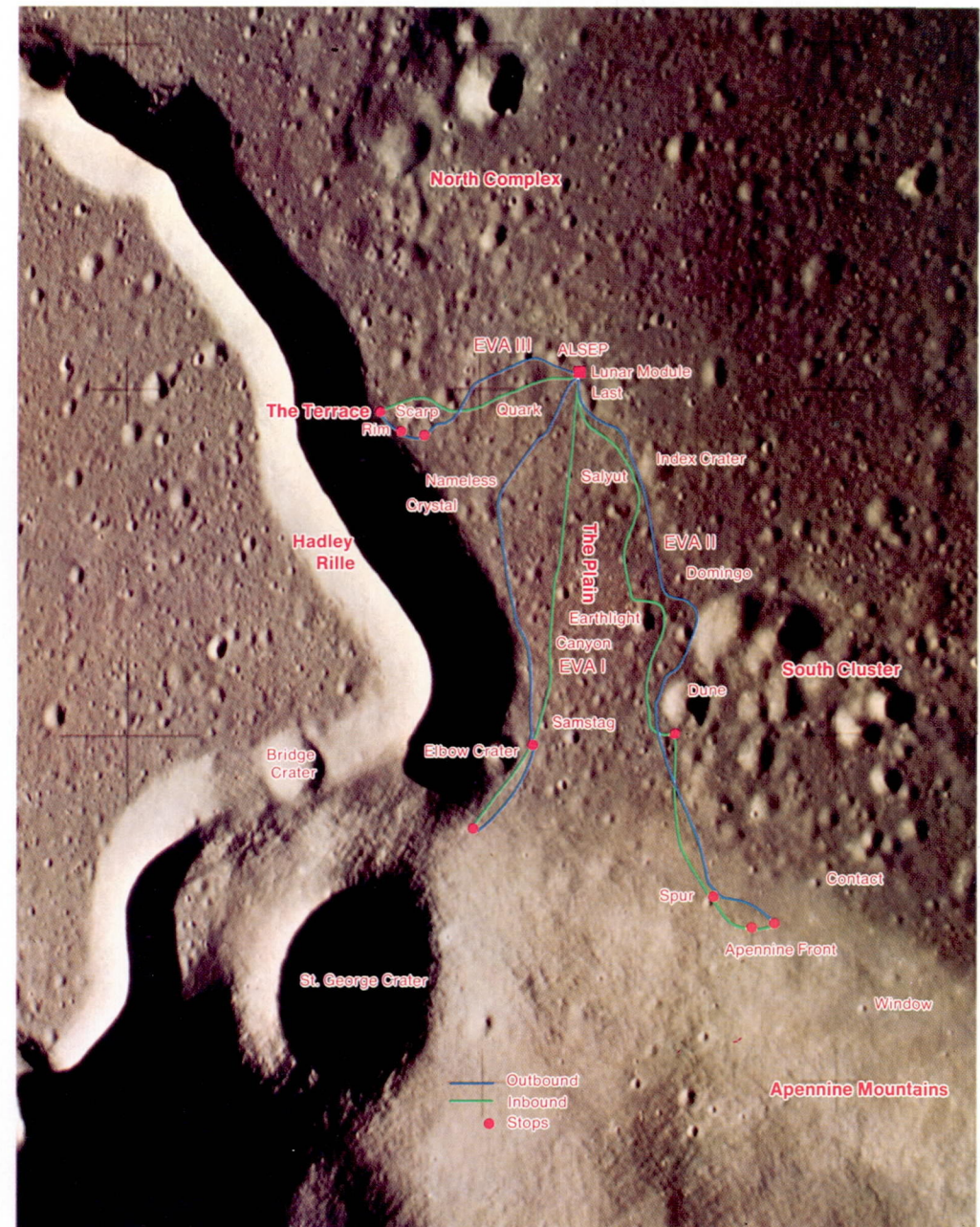
The Moon does not have an atmosphere, does not have a hydrosphere and there is no good evidence that it ever did have them in any significant amounts. So it experienced the same external

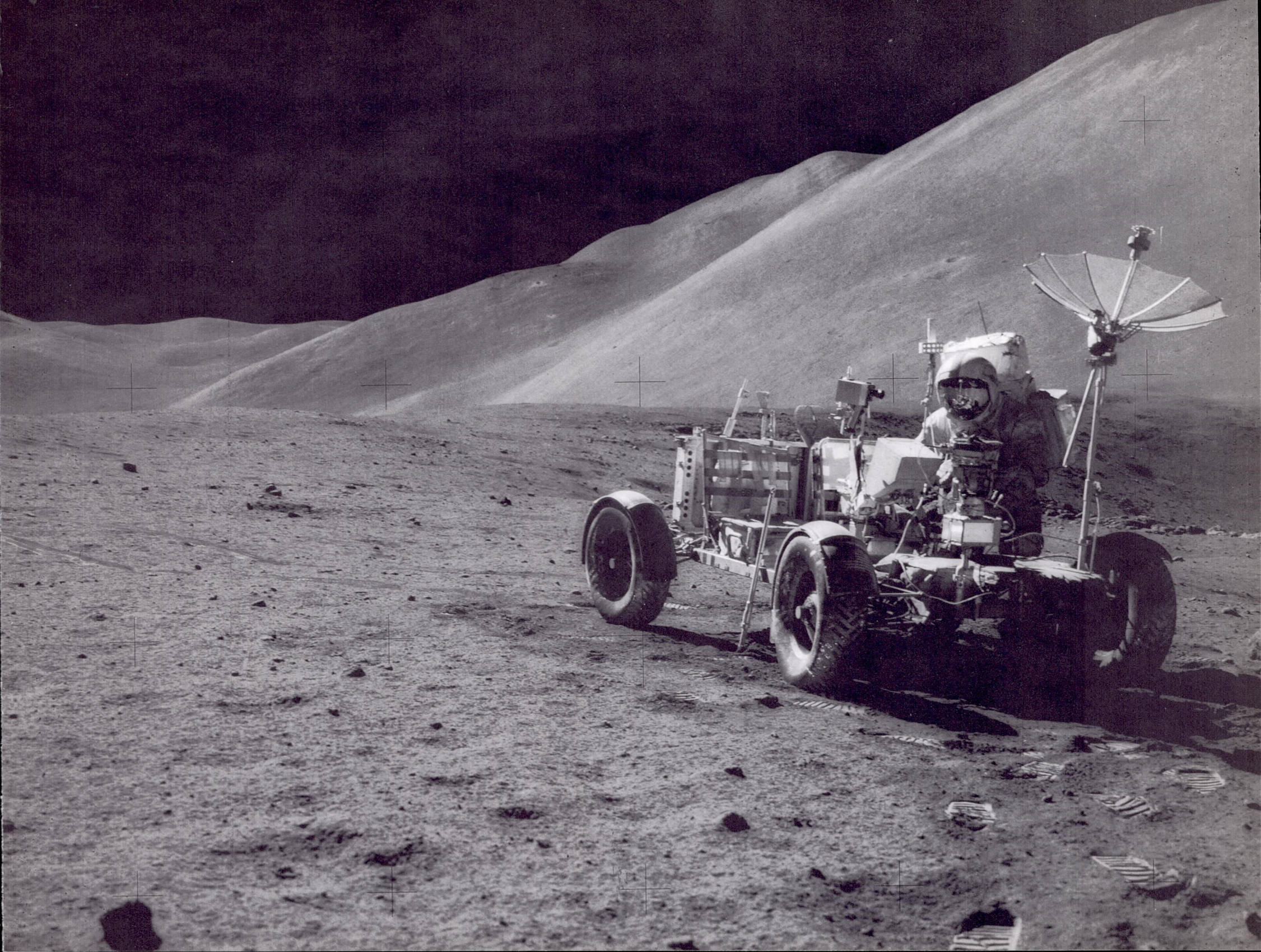
Why is it important to know?

and probably many of the same internal events that the Earth did but it has not been exposed to the last 3 billion years of geologic demolition which occurred on the Earth. We hope that in spite of having to look at the Moon through the effects of subsequent bombardment by meteors, small and large, that we can, by the samples and the observations and the photography and the geochemical experiments—carried now in the command and service modules—that we can start to understand just what happened in this early phase of the formation of the Moon, a terrestrial planet, that is, a body in the solar system of a composition similar to that of the Earth.

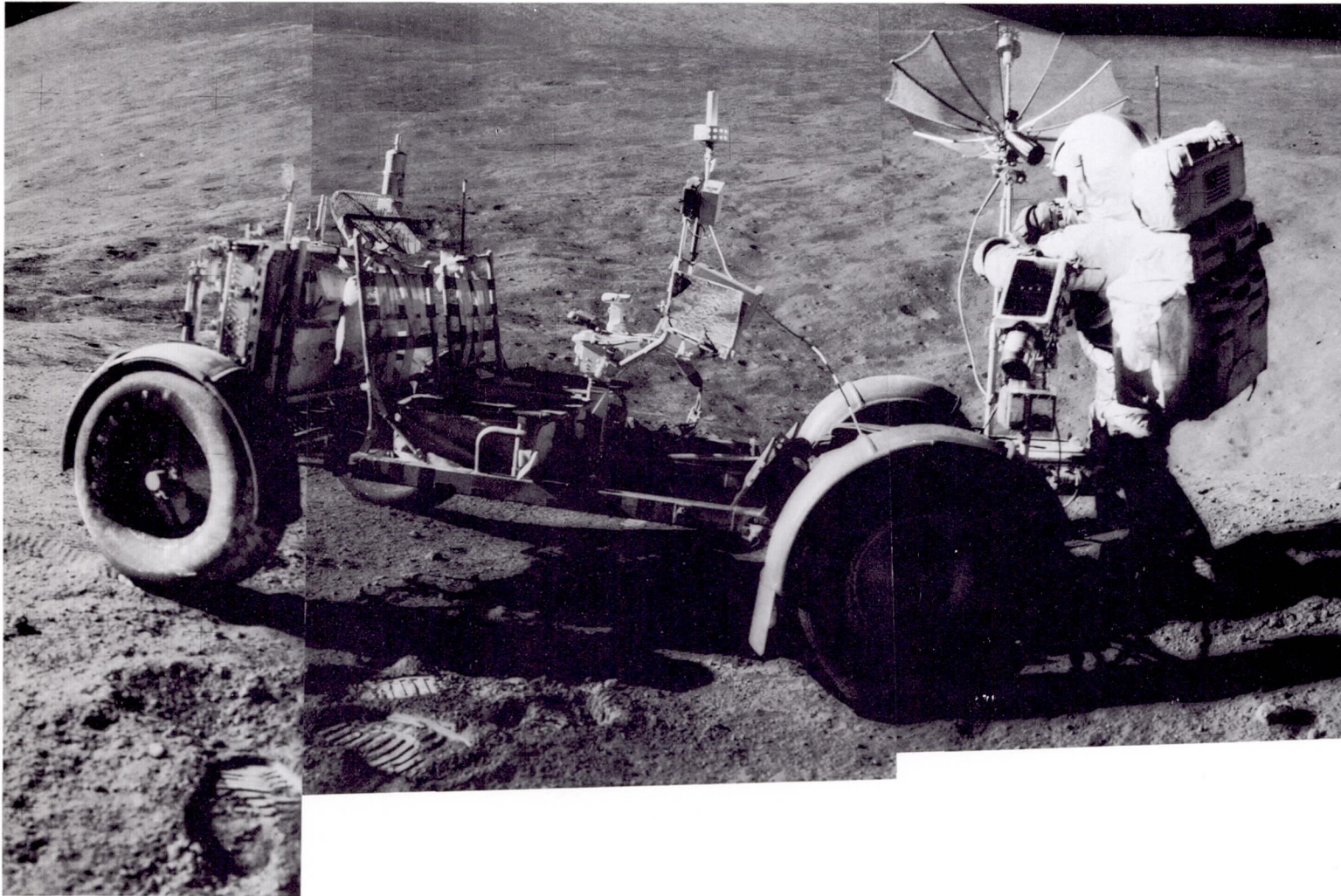
A major objective on EVA 1 and on EVA 2 is to sample the Apennine Front. This Apennine Front bears very directly on understanding the early history of the Moon. The Imbrium basin, which is the largest circular basin on the Moon, we feel now, formed very early in the geologic history of the Moon. This we have deduced from the analysis of the Apollo 14 rocks and from the general geologic character of the Imbrium basin relative to the other features on the Moon.

The Apennine Front represents one of the upthrown rims, one of several rims of mountains, that were created by this Imbrium impact event. By being upthrown—that is, the outer part thrown up and the inner part of the basin dropped down—it exposed a section of lunar crust. How much of a section of lunar crust, we don't really know. That's a very difficult question to answer. You can make some guesses, based on certain other kinds of information about how thick ejecta blankets like the Fra Mauro formation ought to be. Nevertheless, there are some 15,000 feet in the front itself—some 15,000 feet of vertical rock section. We hope to be able to sample this by sampling craters within that





Astronaut adjusts equipment in the front end of the Lunar Rover.



section, such as St. George on the first EVA and Front Crater on the second. In the process of sampling on those first 2 EVA's, we build up a chapter of a history book of that part of lunar time. That is a part of lunar time that preceded the formation of this large circular basin, the Imbrium basin.

The first EVA also, just starts to touch on the question of the rilles. Hadley Rille is in a class commonly called the sinuous rilles. And although it's probably not a classic sinuous rille, such as in the Aristarchus region, where the rilles are extremely sinuous, like parts of the Mississippi in terms of their geometric form, Hadley Rille is one of the more intriguing mysteries about the Moon: How do these sinuous gorges form? You can talk to just about anybody who has been involved in this for any length of time and you'll get a different origin. I have my idea, which is certainly no better, and I hope no worse, than anybody else's. We just have been unable to decide one way or the other from the analysis of photography, what this origin is.

It may turn out that the origin is not really significant to the big question, but then again, we just don't know what's going to be significant. And since it is so intriguing a mystery and we have the opportunity of combining the study of the rille with the more clearly important question of the Apennine Front, it will be touched on in the first EVA and concentrated on in the first part of the third EVA.

What we will try to do is sample the edges of the rille, photograph the walls and visually try to see what kind of clues to its origin are there in what now remains of that rille: whether or not there's a levee on the side of it—that is a buildup of material that has been thrown out of the rille; whether there is any evidence that the rille is solely a pull-apart structure—that is that maybe

the Imbrium basin has contracted significantly with time or sunk significantly in time so that there is just a sinuous fracture formed in that part of the Moon possibly associated with some volcanism up near the head of Hadley Rille.

These are the kinds of things that the crew will be trying to understand, as they view the Hadley Rille, particularly on the third EVA, where we also are going to take high resolution photography, using the 500 millimeter Hasselblad camera, of the farside of the rille, in a way that makes this amenable to photogrammetric analysis. A stereo base line of about $\frac{1}{3}$ of the width of the rille will be established by taking pictures of the same part from each place.

Finally, throughout all of the EVA's—we will be trying to collect the systematic suite of samples that represent the mare bedrock that we've landed on. It's another large part of another mare region on the Moon; and we'll be trying to get the kinds of samples, particularly the core samples, that form the pages of another chapter of lunar history and that is the chapter that developed the regolith. The regolith is the groundup mass of fine grain material that lies on top of every other material that we know about on the Moon. It's in this regolith that we have our other major reason for going to the Moon, both scientifically and with a concern towards understanding the Earth.

If we are ever going to understand the history of the Sun—to document it and then try to understand it—it's probably going to be by understanding the record that the Sun has left in the lunar soil—the regolith. The regolith is built up by repetitive meteor bombardment and by the repetitive superposition of ejecta blankets from these impacts. Every one of these little ejecta blankets is a page in the chapter on the history of the Sun. Whether

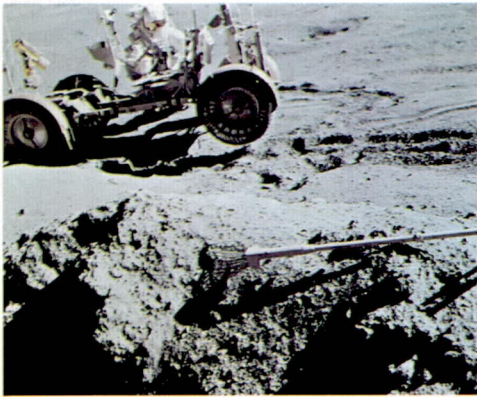
or not we'd be able to understand that history—translate those pages or read them—is a question that will take some time to answer. There are, obviously, some things we can do. We can measure remnant magnetism of small fragments. We can measure the radiation damage of small fragments. But we really must use this material in a systematic way to understand the history of radiation and magnetism coming from the Sun since the formation of the mare some three billion years ago. Now this radiation/magnetism hitting the Moon almost certainly has been affecting the Earth. And there's one major natural control on the environment of the Earth and that's this radiation and magnetism. Unless we understand what kinds of processes are affecting the environment of the Earth—what has been the short and long term history of environment due to changes in the radiation and magnetism impacting it from the Sun—then we can never really hope to fully understand what we have to do to prevent man from destroying this environment; from becoming a competitor with the Sun.

Again we're talking about a long term question here. Man can't compete yet with the Sun, he's surely trying but he can't yet compete with the Sun in terms of changing his environment—total Earth environment. But it won't be long before he can. We all see those trends and it has become a very popular topic in recent years. But the study of the record on the Moon, and later on the study of the daily variations on the Sun such as the Skylab mission will attempt to carry out, are the kinds of things that are going to form the baseline of information and the baseline of understanding so that we can start to tackle this long term 50, 100, 200 year problem—the problem of preserving and protecting the environment on the Earth.

At top, a wide angle photo shows Mount Hadley in the background. Below it is a telephoto of part of Mount Hadley showing steeply dipping lineations. Below, two other telephoto views.



The LRV threatens to slide on the uneven lunar surface, but Astronaut Irwin prevents it by hanging on to the "outrigging."



Scott prepares to identify and collect a lunar sample.



Documentary photograph is being taken with the gnomon beside a sample. The gnomon provides a vertical reference and calibration for determining the size and position of objects, to assist scientific analysis back on Earth.

Sampling scoop was used to retrieve surface materials too small for the tongs, such as sand or dust or small lunar samples.



Television picture shows Scott and Irwin as they team up to take penetrometer tests to determine physical characteristics and mechanical properties of the lunar surface and subsurface.



Astronaut is retrieving a sample, using the spring-loaded tongs to retrieve pebble size and larger samples. The tongs also were used to pick up dropped equipment, since it is difficult to lean over when wearing the space suit.

Boulder field showing rays in a pattern typical of ejecta-material thrown out when a meteorite impacts and forms a new crater.



Astronaut Irwin leaves the Lunar Rover with camera in hand to document lunar samples as they are collected.



Scott beside Rover at the edge of Hadley Rille. Irwin was standing on the flank of St. George crater when he took this photo, looking north along the rille, during the first EVA.



Detail of an area in the picture in center,
showing rock field in the rille seen above the
Rover's antenna.

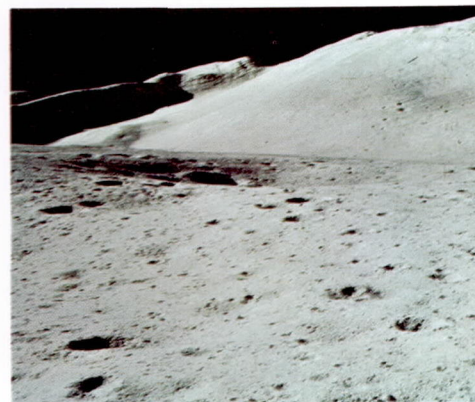
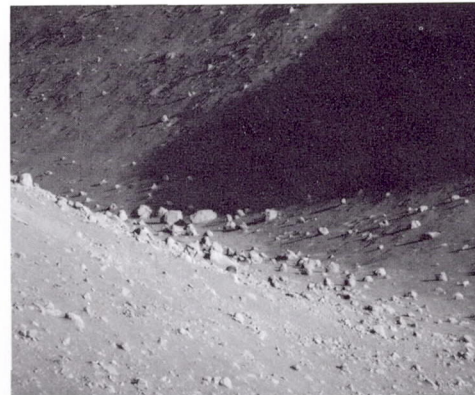
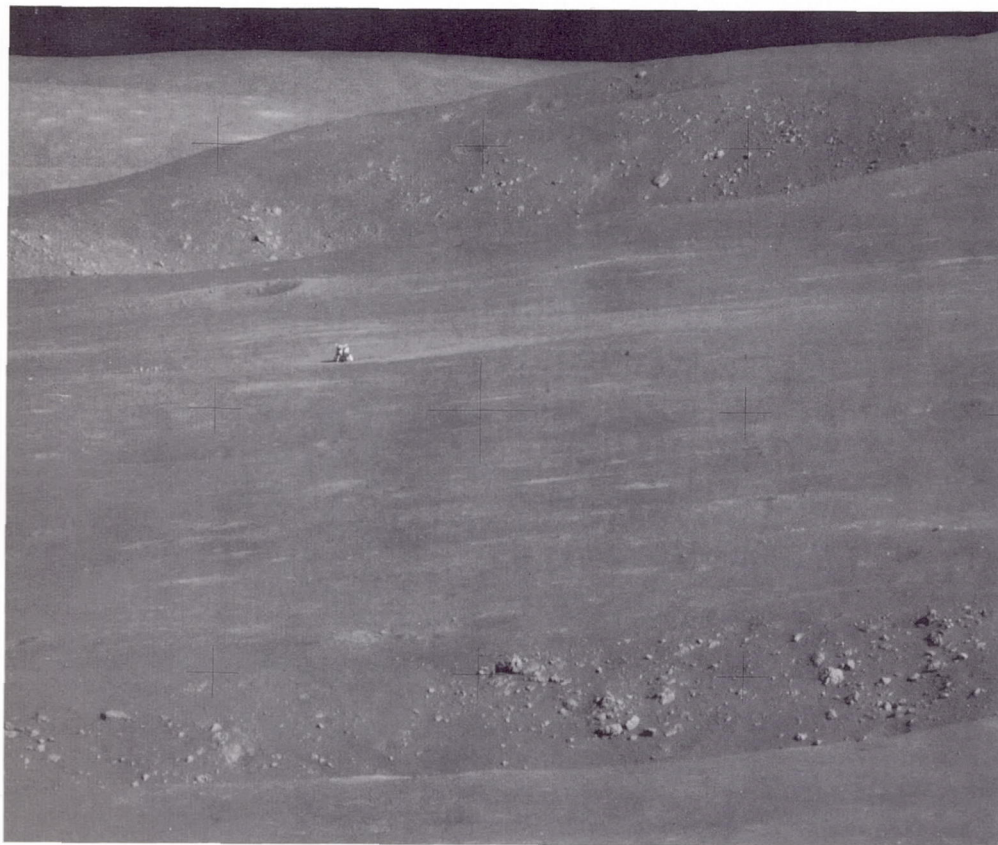


Photo shows surface layering which was noted by
the astronauts and which provides a history of
successive lunar events.

A closeup of the top center portion of the photo
at left showing layering.

The Falcon lunar module on the mare.



Scott prepares to take a documentary photo of a lunar sample. The gnomon is in place at the right side of the picture.



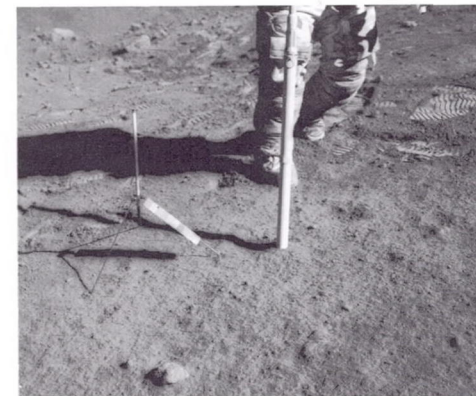
Astronaut digs a trench in the lunar surface to uncover subsurface for photographing and sampling.



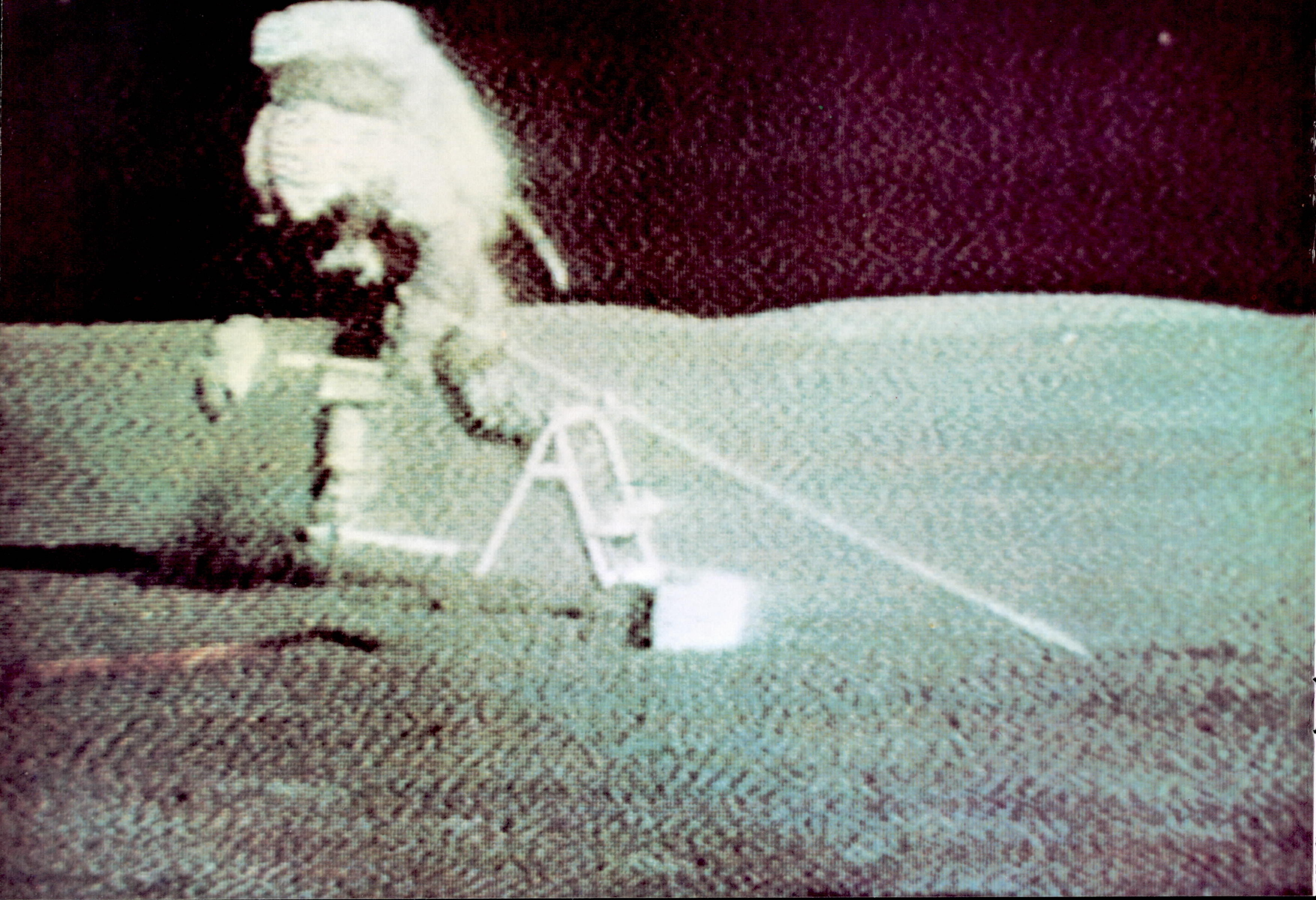
Mission Control Center at Houston manned by ground flight controllers. Direct communication with the astronauts is carried out by CAPCOM, who is an astronaut.



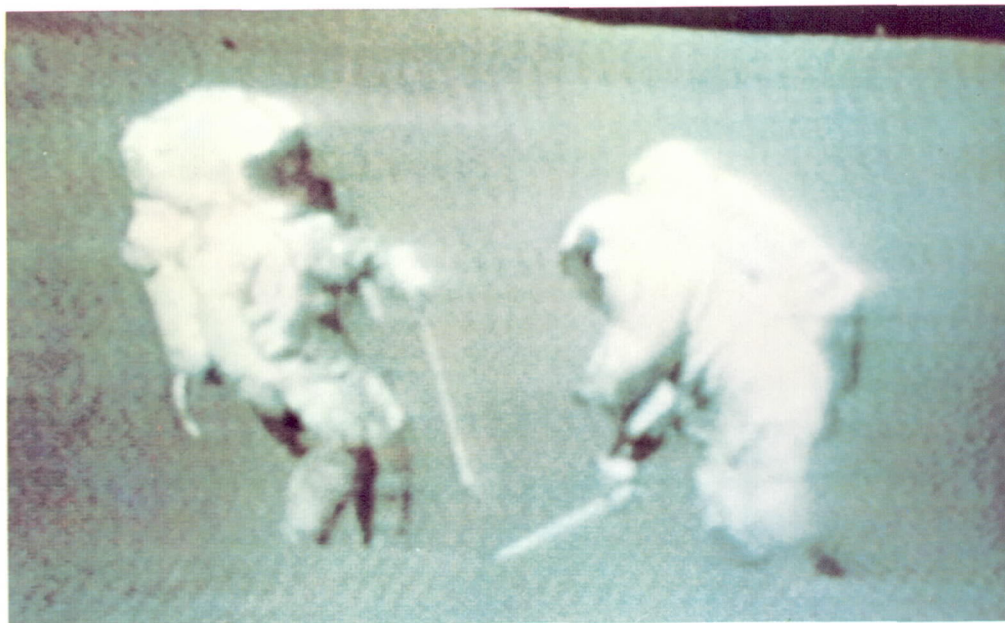
Photo shows rock debris forming the regolith, which is the top layer of the lunar surface.



Astronaut drives core tube into surface to obtain subsurface sample.



Irwin prepares trench while Scott stands by to make penetrometer reading of subsurface material.

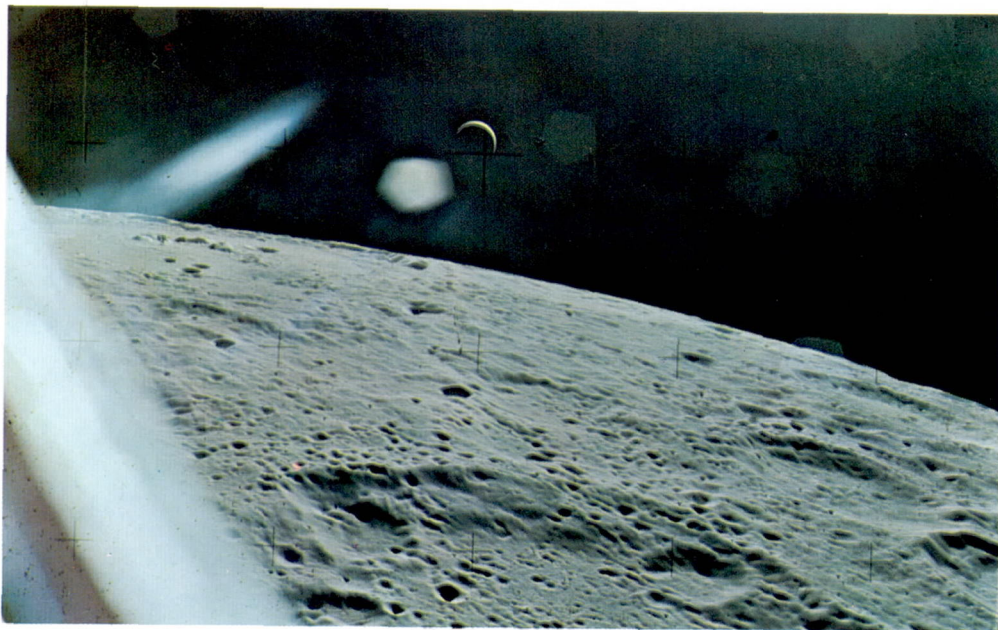


Scott drilling into lunar surface to place heat probes to obtain thermal data from the lunar subsurface.



Scott placed on the Moon a memorial to 14 deceased American and Soviet spacemen. Said Scott: "Many people have contributed to this pinnacle we've reached and we know of 14 individuals who contributed all they had." The memorial consisted of a plaque and a small figure representing a fallen astronaut. It was placed in a small crater about 20 feet north of the place where Rover is parked.

Earthrise on the Moon, as seen from Endeavour
in orbit.

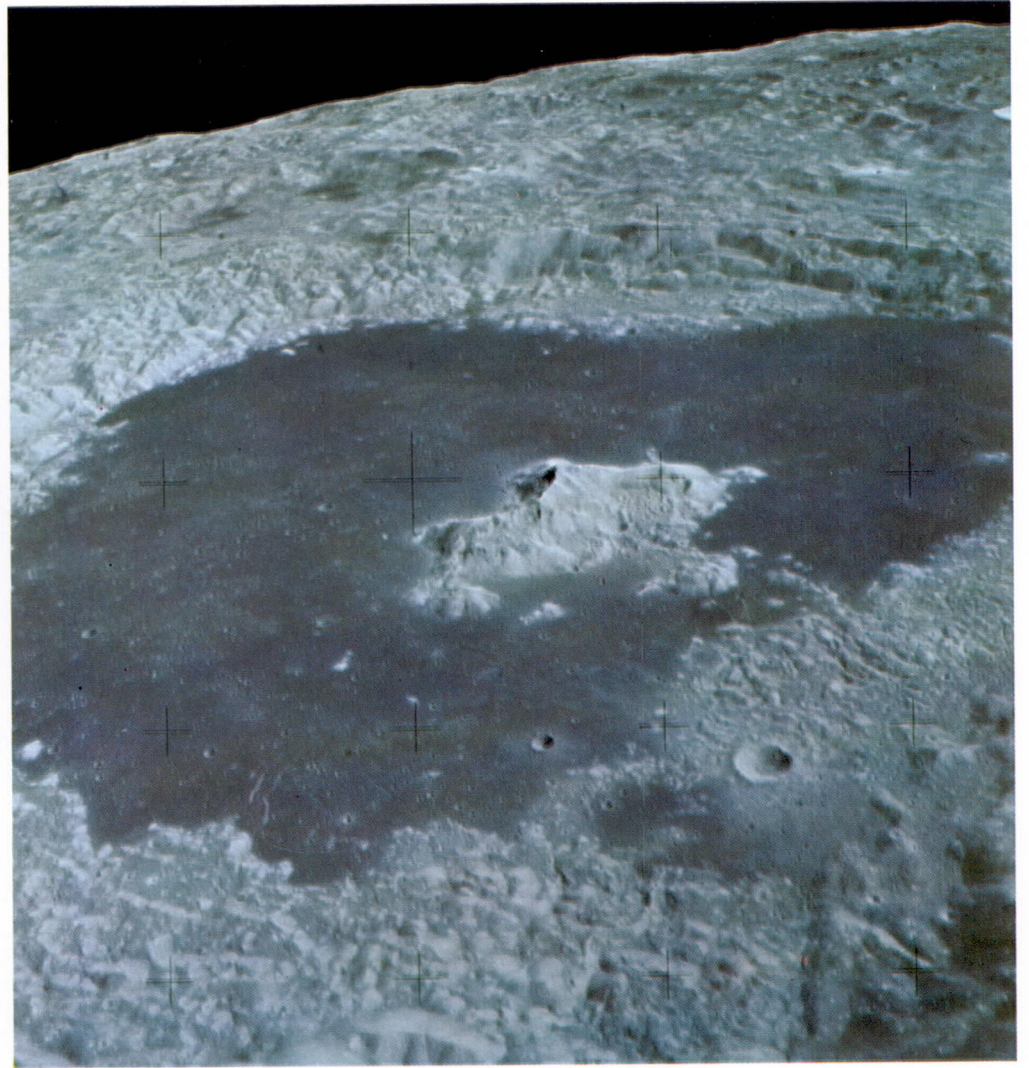


Craters and rilles photographed from lunar orbit.

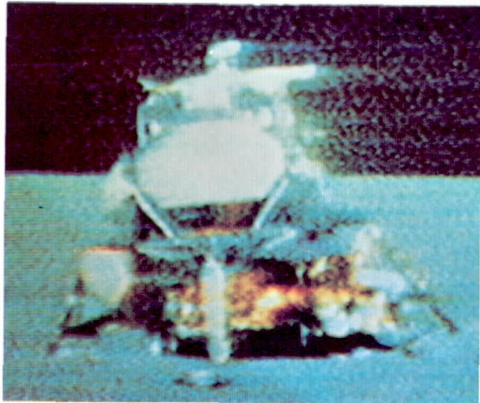


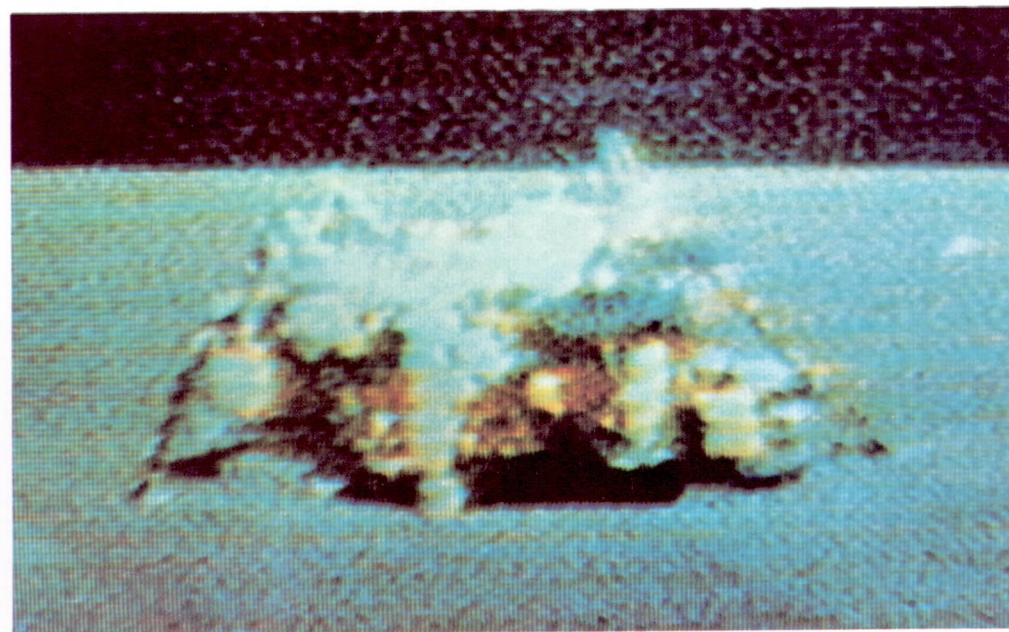
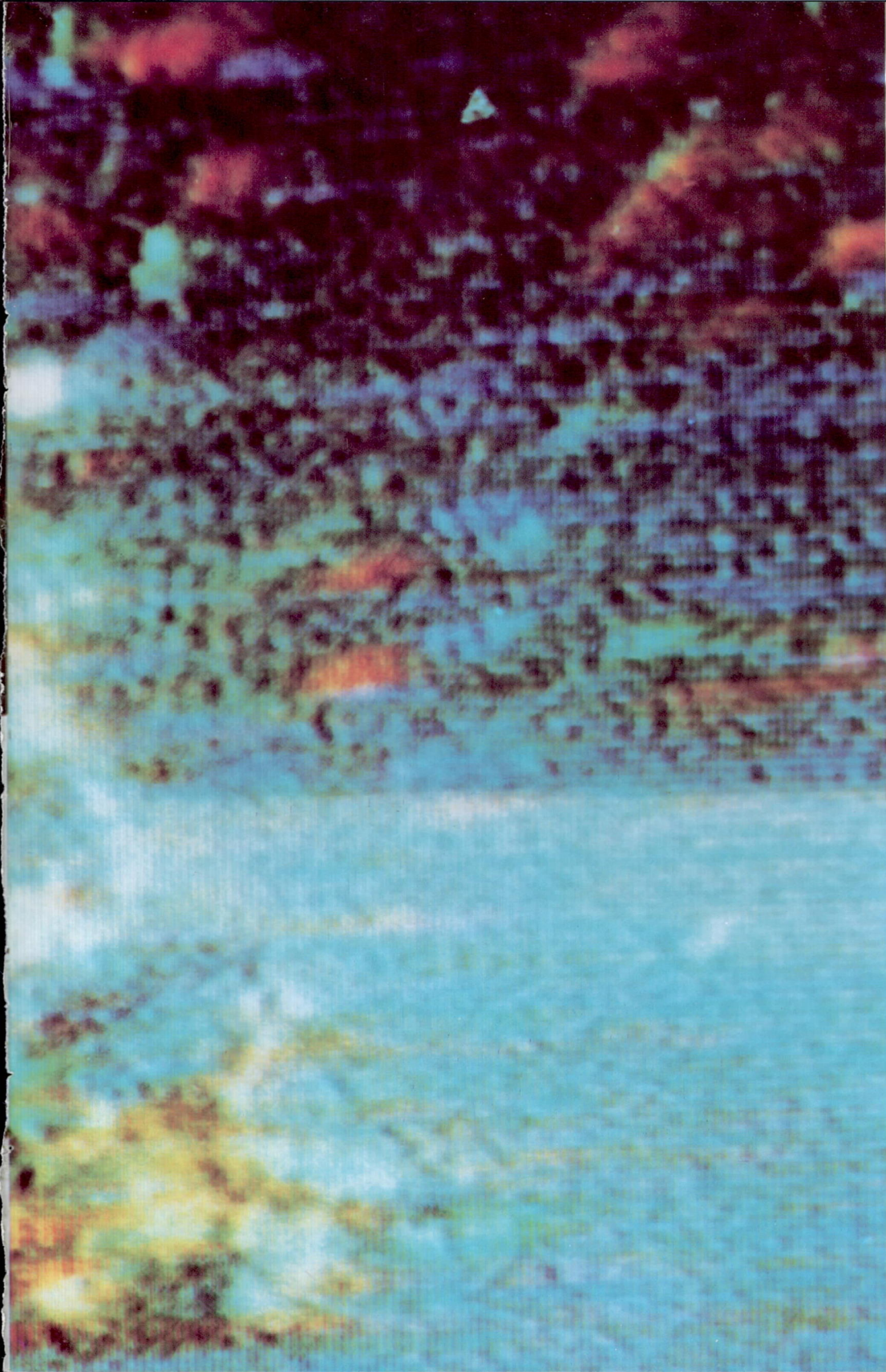


Tsiolkovsky Crater on the backside of the Moon has a mountain rising from the middle of its dark floor.

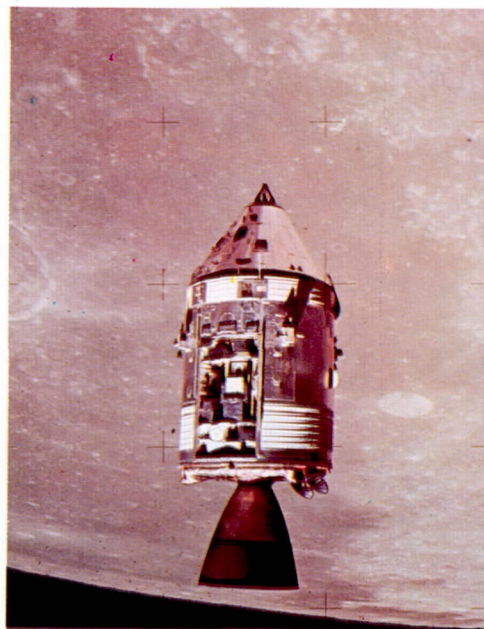


Leaving the lunar surface, the ascent stage of Falcon leaped from its lower stage, which served as a launch pad, and sped into orbit for rendezvous with Endeavour. For the first time there was television coverage of the lunar liftoff, by the TV camera on Lunar Rover parked 300 feet to the east of the LM. The camera was controlled from Earth.

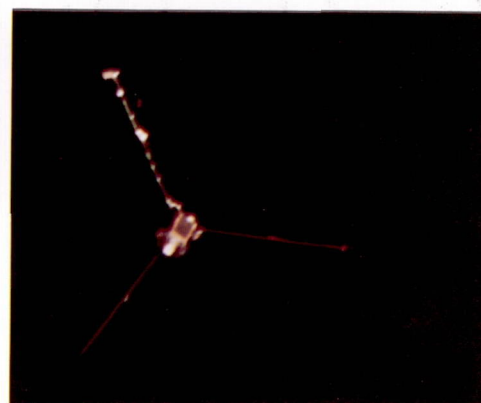
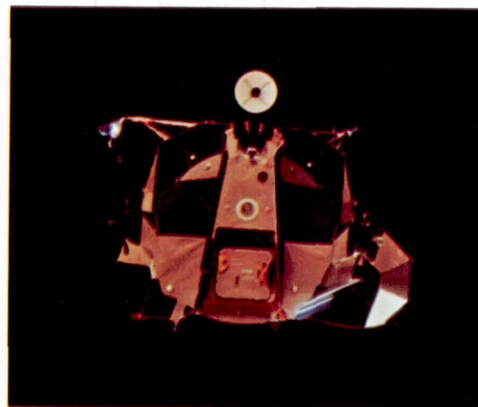




The Apollo 15 command /service module in lunar orbit. In this photograph taken from the lunar module, the Scientific Instrument Module (SIM) bay is seen with the cameras and sensors that recorded data over large areas of the Moon's surface from lunar orbit.

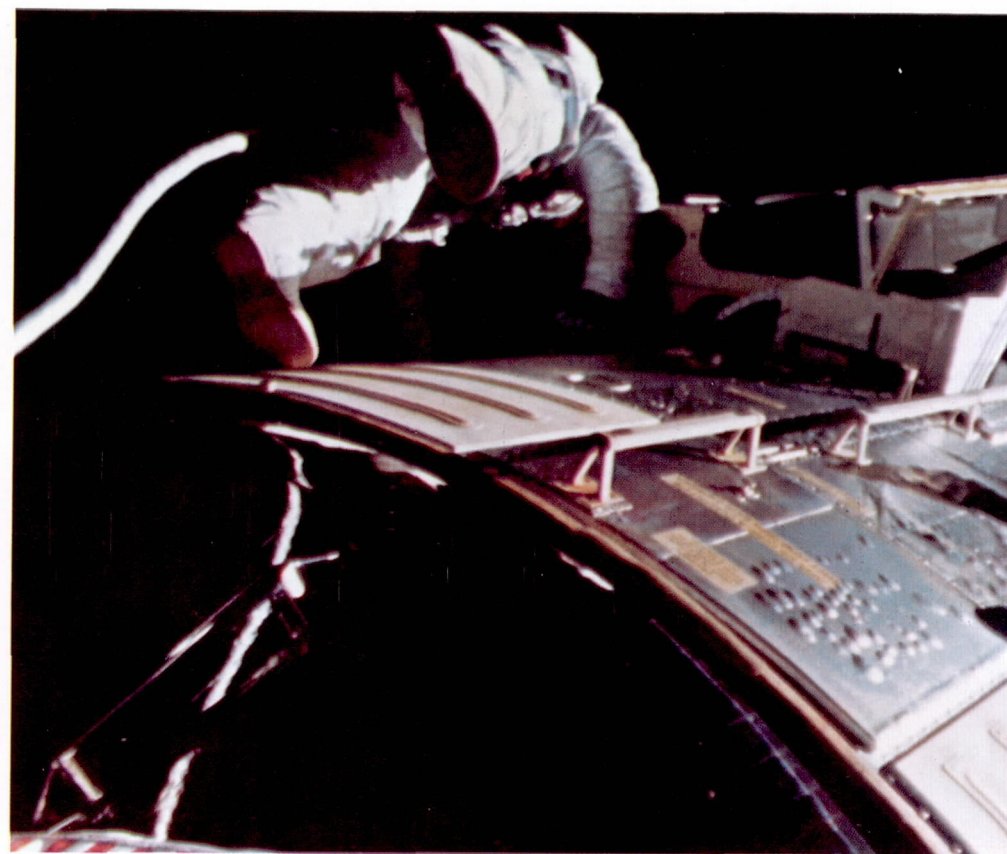


The ascent stage of the lunar module is seen from the command/service module, prior to rendezvous and docking, after lift-off from the lunar surface.

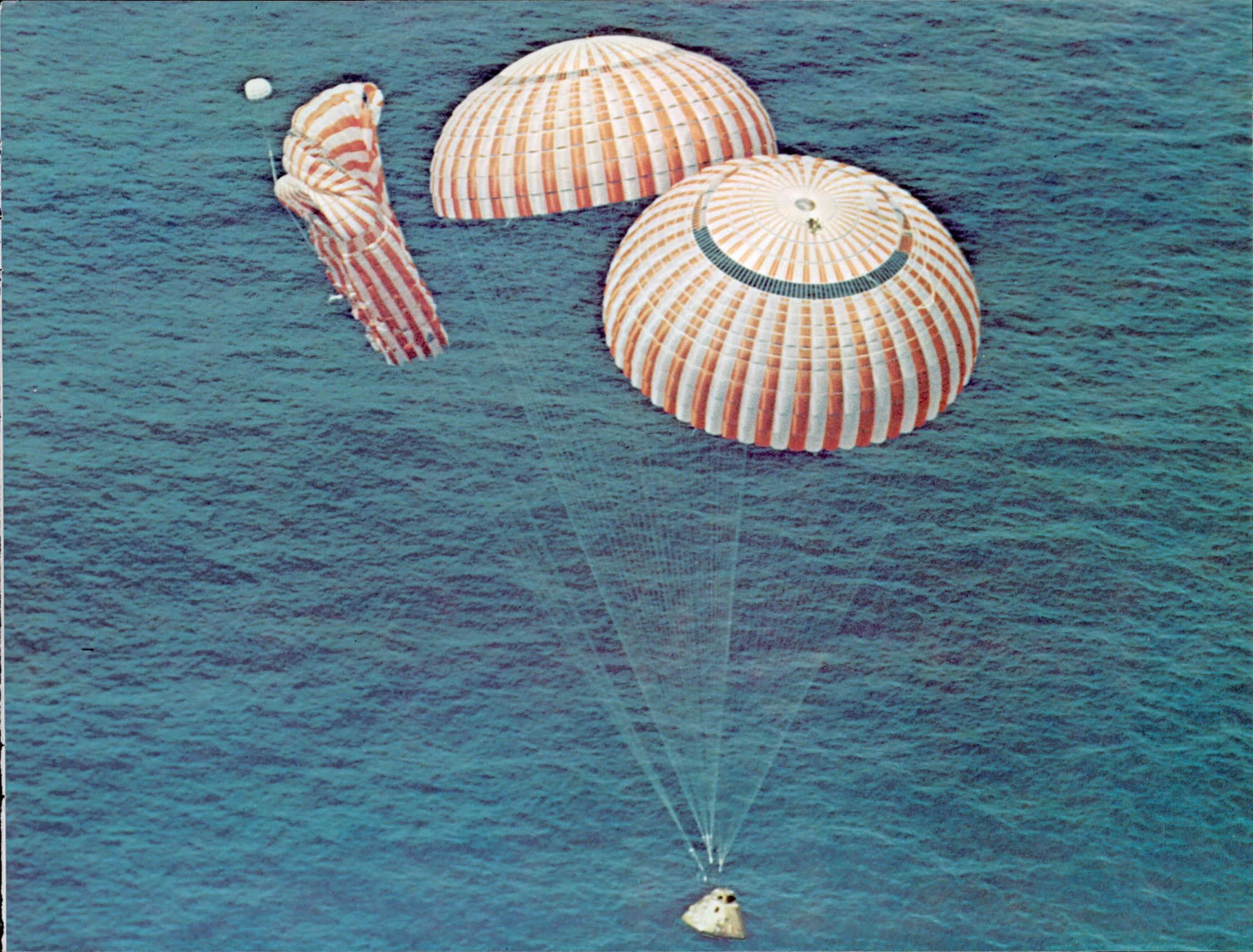


The launch of a 78.5 pound scientific subsatellite took place while the spacecraft was still in lunar orbit. The satellite was launched by the Apollo 15 crew from a bay in the command/service module. Its mission is to gather data for about a year on lunar gravity, mascons, solar flares, the Earth's magnetic field, and the Moon's weak magnetic field.

Seconds before splashdown, one of the spacecraft's three main descent parachutes collapsed, causing an increase in impact velocity from 19 mph to 22 mph. The additional impact velocity did not jeopardize the safety of either the spacecraft or the astronauts.



On August 5 Astronaut Worden climbed out the hatch of the command module and, hand-over-hand, worked his way to the SIM bay to recover the film magazines for return to Earth for analysis. This "space walk" took place 197,000 miles above the Earth.



The Apollo 15 command module is being readied for recovery from the Pacific after the transfer of its crew to the USS Okinawa. The spacecraft is hauled aboard; its cargo of Moon rocks, core samples, film, and scientific data are removed and prepared for shipment to the Lunar Receiving Laboratory in Houston.



The spirit of success is seen on the faces of (l-r) Astronauts David R. Scott, James B. Irwin, and Alfred M. Worden as they await helicopter recovery after their Pacific splashdown. Forty minutes later they were aboard the USS Okinawa to begin their return to Hawaii and then on to the Manned Spacecraft Center in Houston, Texas.



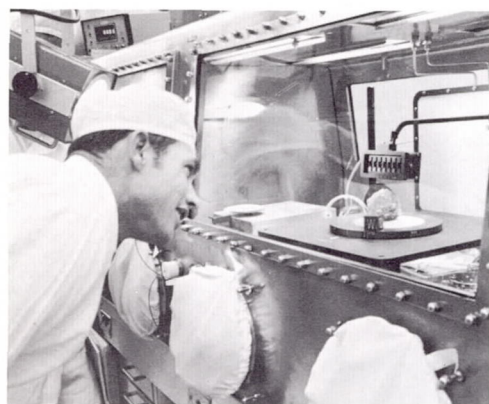
Highlights of the Apollo 15 Mission

DATE (1971)	TIME (EDT)	GET* (hr.: min.)	EVENT
July 26	9:34 am	00:00	Apollo 15/Saturn V lifts off from Cape Kennedy, Fla., toward interim Earth orbit.
	12:24 pm	2:50	Apollo 15 rockets out of Earth orbit toward Moon.
July 29	4:05 pm	78:31	As Apollo 15 sweeps around the Moon, it fires its engine to slow down and go into lunar orbit.
	4:59 pm	79:25	Third stage of Saturn, jettisoned on July 26, crashes as planned into Moon's Sea of Serenity.
	8:14 pm	82:40	Apollo 15 orbit adjusted to lower its perilune to about 10 miles.
July 30	2:13 pm	100:39	Falcon separates from Endeavour.
	6:04 pm	104:30	Falcon begins descent.
	6:15 pm	104:41	Falcon alights on Marsh of Decay in Moon's Hadley-Apennine region (26° 5' North Latitude, 3° 39' East Longitude).
July 31	8:17 pm	106:43	Scott stands up through Falcon's hatch to survey Moonscape.
	9:13 am	119:39	Scott climbs out of Falcon to begin first of three lunar exploration missions. Irwin follows shortly afterward.
	9:54 am	120:20	Scott and Irwin take out and unfold their Lunar Roving Vehicle (LRV).
	11:19 am	121:45	Scott and Irwin start first motor trip on Moon, a drive that takes them to rim of Hadley Rille. They take photographs and rock samples, survey the areas, and drive core tube into soil. Upon return to their landing site, they drill into the Moon to take other core samples and set up ALSEP, laser reflector, solar wind sampler, and United States flag. EVA: 6:34
	7:49 am	142:15	Second EVA starts. Scott and Irwin explore along nearly eight miles of Apennine base. EVA: 7:13.
	4:52 am	163:18	Third EVA starts. Astronauts explore some 7.8 miles along the rim of Hadley Rille. EVA: 4:50.

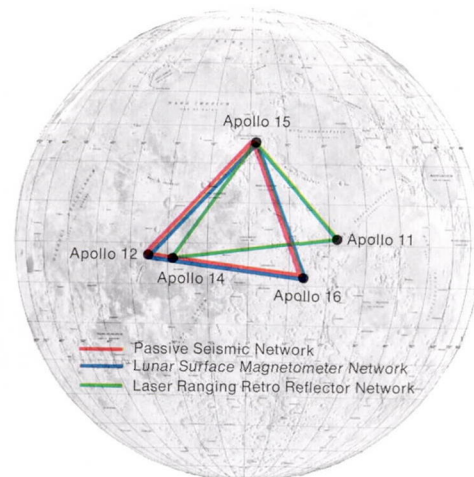
DATE (1971)	TIME (EDT)	GET* (hr.: min.)	EVENT
	1:11 pm	171:37	Falcon takes off in shower of colorful sparks, ending man's longest and most rewarding expedition on the Moon. LRV camera telecasts the event, marking the first time a lunar liftoff has been seen on TV. Cloud of dust in Falcon's wake settles rapidly.
	3:10 pm	173:36	Falcon docks with Endeavour in lunar orbit.
	9:04 pm	179:30	Falcon cast adrift.
	11:04 pm	181:30	Falcon deliberately impacted on lunar surface.
August 4	4:13 pm	222:39	Small subsatellite carrying instruments to study Moon for a year is launched from Endeavour.
	5:23 pm	223:49	Endeavour fires engine to accelerate out of lunar orbit toward Earth.
August 5	11:32 pm	241:58	Worden climbs from cabin of Endeavour and "space-walks" to SIM bay to retrieve two cassettes of film from Scientific Instrument Module. On the film are valuable views of Moon as Endeavour cruised in lunar orbit. Worden's space walk started as Endeavour was approximately 197,000 miles from Earth and traveling about 3,000 mph. This first walk in deep space lasted about 16 minutes, long enough for Worden to complete his assignment.
	4:46 pm	295:12	Splashdown in mid-Pacific north of Hawaii.

*GET — ground elapsed time

Astronaut Scott gets a close look at the sample which has been called the "genesis rock." This crystalline fragment of plagioclase, a mineral which is a primary component of the rock anorthosite, is believed to have formed 4½ billion years ago. When he found this rock Scott said to Mission Control: "I think we got what we came for!"



Apollo Science Stations



Science stations established by Apollo 11, 12, 14 and 15 will be augmented by stations to be deployed in Apollo 16 and 17. The widely separated stations provide not only comparisons for different locations, but also opportunities for triangulation, where useful and effective, as in readings of the passive seismic experiments.

Surface experiments are included in the ALSEP array for each Apollo flight. (ALSEP is an acronym for Apollo Lunar Surface Experiments Package.) Apollo 15 carried experiments in its ALSEP for investigation of seismic activity ("Moon-quakes"), the magnetic field at the lunar surface, the solar wind (electrons and protons emanating from the Sun), measurements of the flow of positive ions, measurements of the Moon's very thin atmosphere and heat flow from the lunar surface.

In addition to the ALSEP experiments, Apollo 15 deployed a Laser Ranging Retro-Reflector and a Solar Wind Composition Experiment. The laser experiment will permit long-term measurements of the Earth-Moon distance by acting as a passive target for laser beams directed

from observatories on Earth. The laser reflector experiment also will help scientists detect continental drift on the Earth, and the wobbling of the Earth as it spins on its axis, which is believed to be associated with Earthquakes. The scientific objective of the solar wind composition experiment is to determine the elemental and isotopic composition of the noble gases in the solar wind, which impacts both the lunar surface and the Earth's magnetosphere.

The Passive Seismic Network (shown in the illustration) was exercised in Apollo 15 when the spent S-IVB stage was sent crashing onto the surface of the Moon, and readings were obtained from the seismometers at the sites of earlier Apollo landings. The illustration shows also the Lunar Surface Magnetometer network and the Laser Ranging Retro-Reflector Network. The projected station for Apollo 16 is indicated; the site for Apollo 17 has not been determined.

Who Was Hadley?

Mount Hadley, Hadley Rille, and the various Hadley craters in the landing site area are named for the British scientist-mathematician John Hadley (1682-1744) who improved reflector telescope design and invented the reflecting quadrant which is a forerunner of the mariner's sextant used for navigation.

Origin of Spacecraft Names

The command ship Endeavour was named for the scientific sailing ship commanded by Captain James Cook, English explorer. The ship was used to explore the Pacific and, among other things, the expedition discovered Australia. The lunar landing craft was named Falcon for the official U.S. Air Force mascot. The crew of Apollo 15 are all Air Force pilots.

Conclusion

On August 7, 1971, the Apollo 15 astronauts returned to Earth bearing about 170 pounds of Moon rocks and thousands of photographs. The rock samples and photographs, plus instrument readings, are already advancing significantly the frontiers of knowledge regarding the Moon and solar system.

On August 12, the Apollo 15 explorers held their first post-mission press conference. They recounted their experiences, showed slides of photographs they had taken, presented a movie of their landing taken from inside of Falcon, and answered questions. Concluding the press conference, Scott said:

"We went to the Moon as trained observers, in order to gather data not only with our instruments but with our minds. I'd like to quote a statement from Plutarch which I think expresses our feelings since we've come back: 'The mind is not a vessel to be filled, but a fire to be lighted.'"